This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

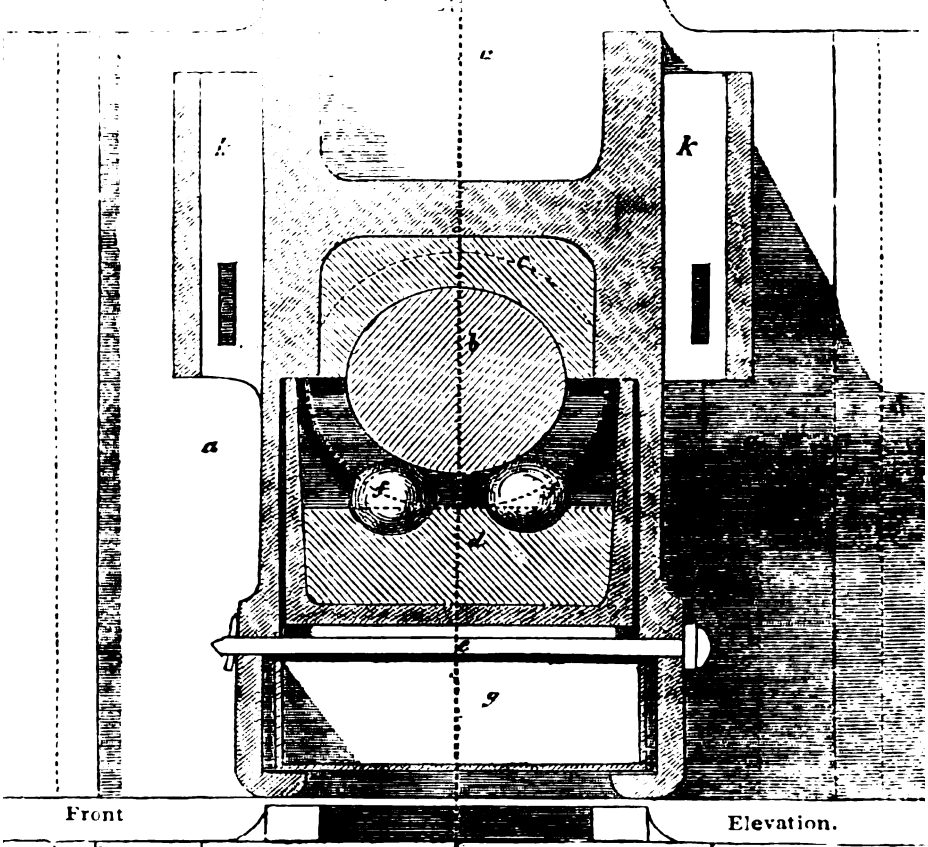
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

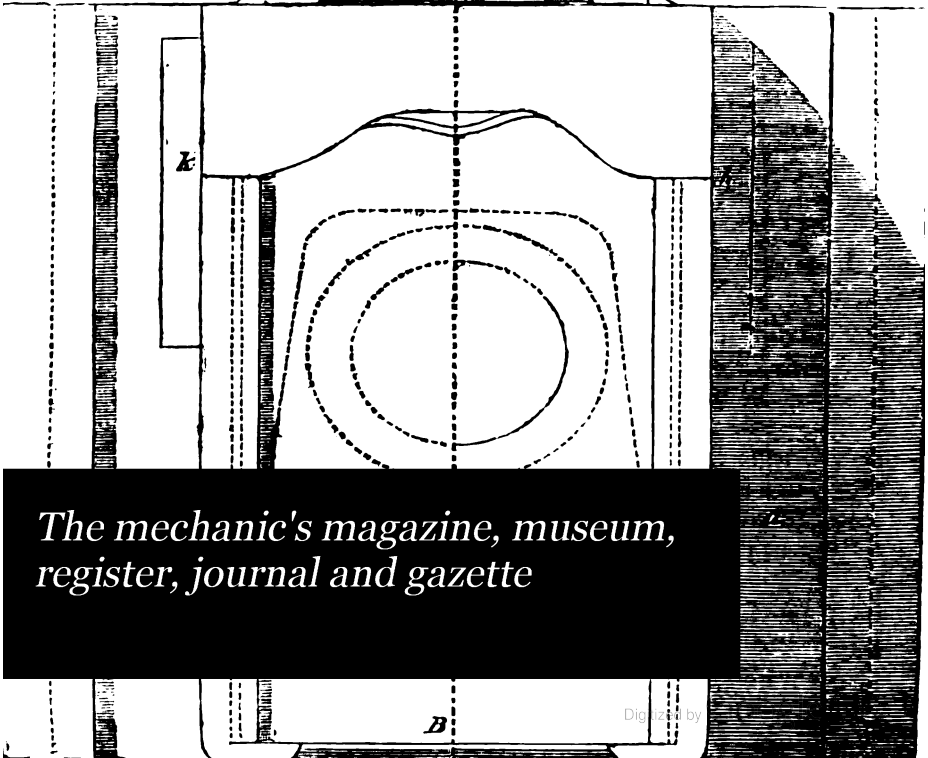
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



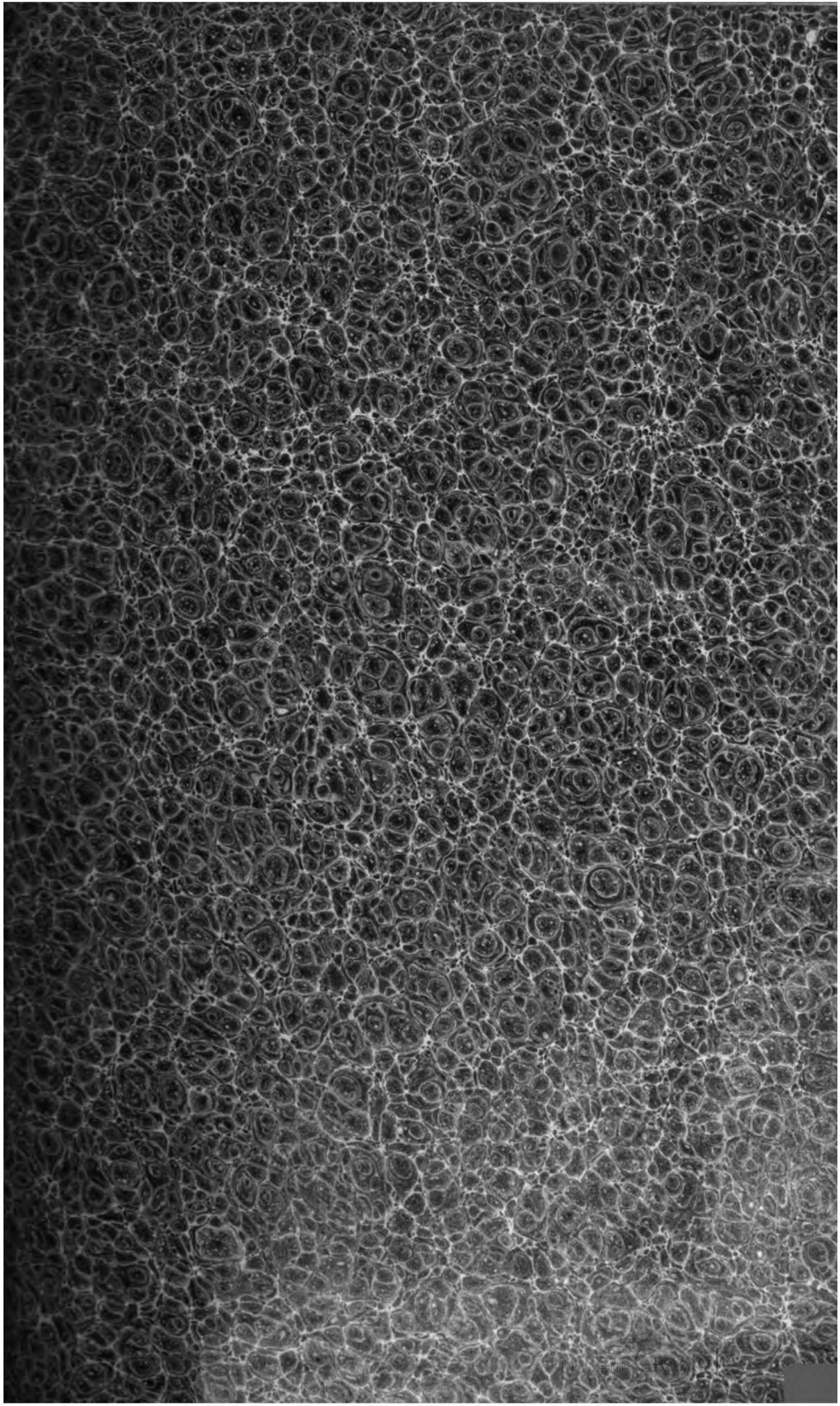


The mechanic's magazine, museum, register, journal and gazette

Digitized by

EK GENT

Digitized by Google



Ma. 862.

Cu16562

Digitized by Google

THE

MECHANICS' MAGAZINE,

MUSEUM,

Register, Journal,

AND

GAZETTE,

JULY 3RD—DECEMBER 25TH, 1847.

EDITED BY J. C. ROBERTSON.

VOL. XLVII.

"There is no art or science that is too difficult for industry to attain to; it is the gift of tongues, and makes a man understood and valued in all countries, and by all nations; it is the philosopher's stone that turns all metals and even stones into gold, and suffers not want to break into its dwelling; it is the north-west passage, that brings the merchants as soon to him as he can desire—in a word, it conquers all enemies, and makes fortune itself contribution."—LORD CLARENDON.

LONDON:

ROBERTSON AND CO.,

MECHANICS' MAGAZINE OFFICE, No. 166, FLEET-STREET.

AGENTS: FOR EDINBURGH, J. SUTHERLAND;
GLASGOW, W. R. M'PHUN, AND DAVID ROBERTSON;
DUBLIN, MACHIN AND CO., 8, D'OLIER STREET;
PARIS, A. & W. GALIGNANI, RUE VIVIENNE;
HAMBURGH, W. CAMPBELL.

1847.

Digitized by Google

PRINTED AND PUBLISHED BY J. C. ROBERTSON, 166, FLEET STREET.

Digitized by Google

INDEX

TO THE FORTY-SEVENTH VOLUME.

Abate's sewer trap, 20, 44
Accelerating force, 231, 309
Actinism, 457
Adcock's patent spray pump, 41, 256, 285, 315, 343, 366, 414, 500, 531, 552
Aerostation, 106, 140, 146, 243, 535
Air, tides in the, 17
——, compressed, locomotive, Baron Von Rathen's, 93
——— Company, Parsey's, 536
Alcoholmeter, Field's, 479
Algebraicæ Horæ, by James Cockle, Esq., M.A., Barrister-at-Law, 13, 134, 150, 306, 331, 499
Alloys, 607
American patents, cost of, to British subjects, 67
——— recent, 67, 234, 459
——— law case, Smith and Sloat v. Mercer and Pechin, 79
——— locomotive, explosion of, 84
——— observations of the new planet Neptune, 250
——— war steamers, new, 262
——— leather trade, 435
——— tapestry carpeting, 458
——— steamers, 559
Analytical geometry, chapters on, by James Cockle, Esq., M.A., Barrister-at-law, 360, 433, 451
Anchor, flat, one-fluked, by J. MacGregor, Esq., 11
Animal electricity, 17
——— and vegetable substances, Horsley's improvements in preserving, 631
Anthracite, on the use of in locomotives, by Professor Johnson, 411
Anti-friction, metal, Babbet's, 535
Archimedes screw, employment of for pumping, 557
"Architectural maxims," by Professor Donaldson, 224
Arctic expedition, 463
Arndt's patent "cloth moth harbour," 235
Articles of utility registered, lists of, 23, 47, 71, 95, 119, 143, 167, 191, 215, 239, 262, 287, 320, 344, 368, 392, 417, 439, 464, 488, 512, 536, 560, 585, 609, 632
Ashbury's improvements in washing and amalgamating gold and silver, 234
Ashenhurst's folding music and reading desk, 229
Atmospheric railway system, 214, 260, 457; Cunningham and Carter's patent, 283
——— tides, 17
——— resistance, law of, 410
Athey's self-acting scales, 382
Axle bearing, Mallet's patent, 180
Axles, causes of the fracture of, 625
Ayckbourn's life preserver and swimming belt, 334
Azulay and Solomon's improvements in manufacturing artificial fuel, 606, 632

Babbet's anti-friction metal, 535
Baby-jumpers, 190
Baddeley, Mr., on the effect of premiums, 137; on aerial navigation, 140; every-body's fire engine and universal force-pump, 299
Bagley's improvement in the ever-pointed pencil, 459, 460
Bain's new system of electro-telegraphic communication, 25, 49, 73
Balances, on, by F. Peale, Esq., 301
Balloon, archimedean, Pitter's, 64
Bank-note paper, improvement in, 618
Barrel staves, Lester's patent for shaving and jointing, 235
Bashforth's table for the calculation of earth works, 15, 249
——— method of describing the evolute of the ellipse, 309
Bath, national economic, Tilke's, 228
Beams and girders, Gibbon's improvements in trussing, 454, 472
Beard v. Egerton and others, (patent law case) 45
Becchöide, the, new cluster of stars, 190
Beck, Dr., award of medal to, by the Royal Society, 131
Bedsteads, Debow's extension frame for, 68
Bees, protection of, from the moth, 235
Bell's loam moulders' crane, 204
Bentham's, General Sir Samuel; plans for making water works subsidiary to the extinction of fires, 516; mode of securing bolts, 583
Berlin castings, 213
Bernoulli's numbers, and indeterminate coefficients, by Professor Young, 574, 627
Biddery ware, 607
Blacksmiths' tuyeres, Grannis's improvement in, 460
Blast-furnaces, Yate's patent, 20
—— pipes, locomotive engine, 549
Bleached linen-yarns, drying, by Davison and Symington's process, 558
Bleaching and scouring, Brooman's patent improvements in, 563
Blewitt, R. J., Esq., M.P.; statement of the experiments with Adcock's spray pump, 533
——— patent improvements in malleable iron, 552
Bobbin-cutting machinery, Larrard's improvements in, 606
Boiler explosion at Rochdale, 456
—— explosions, causes of, 547
Boilers, tubular, Fossick, Hackworth and Elliott's, 241
——, experiments on the scales of, 554
Bolts, clenching, 583
Bonnets, tortoise-shell, 213
Boots and shoes, Hart's machine for lasting, 460
Boring apparatus, Fauvelle's, 463
Bourne's "Catechism of the Steam-engine," 476
Bowman's experiments on the relative strength of cast iron, chilled and unchilled, 520
Brace, eccentric lever, Fenn's, 276
Bracket girder, Dredge's, for bridges, &c., 60, 133, 380
Braithwaite's patent improvements in heating, lighting and ventilating, 217
Break, railway, Mr. George Stephenson's, 274
——, Tibbit's patent, 371
Brett and Little's patent improvements in electro-telegraphy, 185
Brett's, Jacob, patent electric printing telegraph, 11
Bricks, tiles, &c., Cox's process for preserving, 600
Britannia tunnel over the Menai Straits, 176
Bridges: Dredge's balanced bracket girder, 60, 133, 300; investigation of the strength of girders, by W. Dredge, Esq., C.E., 101, 205, 332; remarks on Mr. Dredge's paper, 152, 220, 429; skew piers, 132; the Britannia tunnel over the Menai

Digitized by Google

Straits, 176; safe mode of working the tunnel, 428, 486; wire suspension bridge over the Ohio, 190, 555; Remington's aerial bridge, 259; tubular bridge over the Conway, 463; Pont aux Doubles at Paris, 555
British Association, Oxford meeting, 17
Bronzed cannon, 70
——— medals, 608
Brooman's patent turn-tables, 467
——— improvements in scouring and bleaching, 563
Brown, Mr. Thomas, C.E., R.N., Treatise by, and Professor Main, on the indicator and dynamometer, 528
Brown's patent disinfecting processes, and artificial manures, 200
Brushes, painters', 535
Bryant and Tothill's patent transposing plough, and land transposing system, 491
Buckingham Palace, the new building at, 348, 388
Buffers, railway, 20, 43, 139, 222, 249, 278, 327, 461, 486; break of buffers not a consequence of break of gauge, 204
Burners, gas, Wilkins and Co's. patent diagonal, 1

Calendar of specifications of patents of inventions, 93, 117, 140, 165, 185, 212, 238, 260, 286, 556
Cambridge, Euclid at, 568
———, Descartes at, 592
Camels, marine, Taylor's, 209
Can, Fielden's patent oscillating, 515
Canals, new steam-boat for, 584
Canes, Partridge and Penang, 213
Canisters, gunpowder, metallic, 600
Cannon, bronzed, 70
———, portable, 189
Carbonate of lead, Gannal's new process of manufacturing, 257
Carpeting, tapestry, American, 458
Carriages, self-carrying railway, for common roads, Wrigg's patent, 194
———, drawing and drawn, railway friction considered in respect to, 432
———, railway, Taylor's patent improvements in, 583
Cartridges, Dr, Jaeger's patent improvements in, 419
Cast iron, experiments on the relative strength of, when chilled and unchilled, by R. Bowman, Esq., 520
Casting and moulding, Darling's patent improvements in, 605
Cayley, Sir George, Bart.; railway buffers, 222, 327; artificial hand, 381
Cellar plate, coal, Greenfield's, 505
Cement, roman, 487
Centrifugal governor, new application of, 463
Centurion Papers, 55, 88
Chance's patent improvements in glass, 605
Chapman's transparent paper-cloth, 536
Charcoal, Azulay and Solomon's improvements in manufacturing, 606, 632
Chariot, duplex, Rock and Son's patent, 247
Chemical action arrested by mechanical vibration, 608
Chloroform, 558
Chronometers, electric, 189
Clark, Hyde, Esq., electrical organs suggested by, 545
Clarke and Barber's improvements in dressing and pressing looped and woven fabrics, 395
Clenching bolts, 583
Clip, Hawkins' patent, 277
Clocks, electric, advantages of at sea, 155
Cloth paper, Chapman's, 536
Cloth moth harbour, Arndt's patent, 235
Coal-cellar plate, Greenfield's, 505
Coathupe's improvements in guncotton, 213
Cockle, James, Esq., M.A., Barrister-at-law; Horæ Algebraicæ, 13, 134, 150, 306, 331, 409; Analytical Geometry, 360, 433, 451; method of vanishing groups, 504; reduction of a function to the second degree, 547; light under the action of magnetism, 575
Coefficients indeterminate, and Bernoulli's numbers on, by Professor Young, 574
Coffee-pot, Walker's patent, 478
———, traveller's, by John MacGregor, Esq., 550
College of Preceptors, 107
Compass, natural, 190
Composition ornaments, 510
Compressed air locomotive, Baron Von Rathen's, 93
——— company, Parsey's 536
Condenser, steam-engine, Craddock's patent, 97
Congreve rockets, 559
Conjurors, three, 511
Contraction and expansion of bodies by heat, 405
Conway, iron tunnel over the, 463
Cooling of water below the freezing point, 488
Couche de Niveau, 558
Cox's improvements in preserving and preparing wood, bricks, tiles, &c., 600
Craddock's patent improvements in steam-engines, 97, 121, 156, 169, 265, 308, 380
Crane, loam moulder's, Bell's, 204
Croll *v.* Edge, (patent law case,) 45
Crosley, H., Esq., on the extraction of sugar from the cane, 311
Cunningham and Carter's atmospheric railway, 283
Curr's "Railway locomotion and steam navigation," (review,) 335, 438
Currycombs, Wheeler's patent, 68
Cuttings, railway, short method of determining the slopes of, 430

Daguerreotyping lightning, 190
Dahlia, blue, seekers, encouragement to, 213
Darling's patent improvements in casting and moulding, 605
Davies, Professor, F.R.S., L. & E., geometry of the line and plane, 8, 34, 108, 384, 473, 524; law of atmospheric resistance, 410
Davison and Symington's desiccating processes, 202, 558
Davy, monument to, 530
Deane, Dray and Deane's grain-sifter and polisher, 228
Deane, Dray and Deane's farm fire-engine, water, and liquid manure distributor, 508
Debow's extension frame for bed steads, 68
Descartes at Cambridge, 592
Decimal notation, 20, 92
De La Haye, Mr. John, theory of etherization by, 54
Deodorizing and disinfecting processes, Ellerman's patent, 427, 501, 631
Desiccating processes, Davison & Symington's patent, 202, 558
Designs, registered, for articles of utility, 23, 47, 71, 95, 119, 143, 167, 191, 215, 239, 263, 287, 320, 344, 368, 392, 417, 439, 488, 512, 536, 560, 585, 609, 632
Desk, folding, music and reading, Ashenhurst's, 229
Discoveries of the past year, 17
Disinfecting processes and artificial manures, Brown's patent, 200
——— and deodorizing processes, Ellerman's patent, 427, 501, 631
Diviner, a, 559
Domestic telegraph, Rose's, 358
Donaldson's, Professor, "Architectural Maxims," 224
Doull's patent railway and steamboat signals, 145
Dredge's, (J.) balanced bracket girder for bridges, &c., 60, 133, 380
Dredge, W., Esq., C.E., investigation of the strength of girders employed in the construction of bridges, 101, 152, 205, 230, 332, 429; expansion and contraction of bodies by heat, 405; girders and tensile rods, 544; hints on ventilation, 628
Duplex chariot, Rock and Son's patent, 247
"Dynamics of a rigid body," Griffin's Treatise on, (review,) 596
"Dynamometer and indicator," Messrs. Main and Brown's Treatise on, (review,) 528

Earthwork, "Bashforth's table for facilitating the calculation of," (review,) 15, 249
——— tables, Sibley & Rutherford's, (review,) 138, 191
Eccentric lever brace, Fenn's, 276
Echol's patent method of propelling, 235
Electric chronometer clocks, 189; advantages of, at sea, 155
——— currents, velocity of, 256
——— railway, 559
——— telegraph vocabulary, and the phonetic system, 155
Electricity, animal, 17
——— lighting by, Staite's patent, 44, 462
Electro-magnetic battery, Swan's new solution, 70
Electro-telegraphy: progress of, 18; Jacob Brett's electric printing telegraph, 11; Bain's new system, 25, 49, 73; Swan's new solution, 70; Poole's improvements, 41; Morse's improvements, 68; House's improvements, 68; insulation of signal posts, 94; collectanea electro-telegraphica, 183; reporting by telegraph, 184; the corn market and the

Digitized by Google

telegraph, 184; the longest line —as yet, 184; new position for the ground plates, and new battery solution, 184; should governments have the superintendence? 184; telegraphing of coming storms, 185; application to fire-engine stations, 185; the proper wire to be used, 185; Brett and Little's patent, 185; new effect of the magnetic telegraph, 262; determination of longitude by the magnetic telegraph, 341; Hatcher's improvements, 356; transmission of the Queen's speech, 559
Electrotype plating, 488
Elimination of linear equations, by Professor Young, 424
Ellerman's patent deodorising and disinfecting processes, 427, 501, 631
Ellicott and M'Crove's reverberatery furnace, 236
Ellipse, method of describing the evolute of the, by F. Bashforth, Esq., 309
Engine-drivers and passengers, simple method of communication between, 486
Engineers, use of mathematical knowledge to, 4, 31, 197, 230, 245, 340
Engelbrecht and Skiff's improvement in fish-hooks, 461
Equations, linear, on the elimination of, by Professor Young, 424
Ether engine, Tremblay's, 559, 599
Etherization, 18, 22, 54
——— of old date, 463
——— superseded by chloroform, 558
Euclid at Cambridge, 568
Evolute of the ellipse, method of describing, by F. Bashforth, Esq., 309
Expansion and contraction of bodies by heat, 405
Explosion of the Cricket steamboat, 214, 316, 343
———— of a boiler, at Rochdale, 456
Explosions, causes of, 547
Exponential theorem, an, simple investigation of, by Professor Young, 546

Fabrics, looped and woven, Clarke and Barber's patent improvements in, 396
——— warp net, Glover's patent improvements in, 431
Fan-blowers, 535
Fauvelle's boring apparatus, 463
Fenn's eccentric lever-brace, 276
Field's alcoholmeter, 479
Fielden's patent oscillating can, 515
Filtering-cock, Wenman's patent, 67
Fire-arms and cartridges, Dr. Jaeger's patent improvements in, 419
Fire-engine, everybody's, and universal force-pump, Mr. Baddeley's, 299
————, farm, Messrs. Deane, Dray, and Deane's, 508
Fires, extinction of, Sir Samuel Bentham's plans for, 516
Fish-hooks, Engelbrecht & Skiff's, improvement in, 461
Fitzsimmon's process for purifying whale-oil, 67
Forces, parallelogram of, notes on the demonstration of, in the translation of Poisson's Mechanics, 38, 115
Forging and welding, 607
Fossick, Hackworth, and Elliot's tubular boilers, 241
Fountain, the highest, 190
Fracture of axles, causes of, 624
Franklin's oil and water experiment, 548
Friction, questions in, solved, 140, 154
——— railway, considered in respect to drawing and drawn carriages, 432
Fuel, artificial, Azulay and Solomon's, 606, 632
Furnaces, blast, Yates' patent, 20
————, reverberatory. Ellicott and M'Crove's, 236

Gannal's new process of manufacturing white lead, 257
Gas-burners, Wilkins and Co's. patent diagonal, 1
—— engine, new, 511
Gaskin, Rev. Thomas, M.A.; "Solutions of Trigonometrical Questions" (review), 436; "Geometrical Problems" (review), 619
Gauge, break of, question, 187, 204
———, mixed, 453
Gauging, short methods in, 426
"Geometrical Problems, Gaskin's Solutions of," (review), 619
Geometry of the line and plane, by Professor Davies, 8, 34, 108, 384, 473, 524.
———, analytical, chapters on, by James Cockle, Esq., M.A., Barrister-at-law, 360, 433, 451
Gibbon's patent improvements in trussing beams and girders, 454, 472
Girders, iron, investigation of the strength of, by Wm. Dredge, Esq., C.E., 101, 205, 332, 544; remarks on Mr. Dredge's paper, 152, 220, 429; deflection of girders at different velocities, 132; Gibbon's patent improvements in trussing, 454, 472
Glasco's patent railroad wheels, 68
Glass, malleable, said to be re-discovered by Schœnbein, 70, 223
—— tubes, method of jointing and laying, 57
——, Chance's patent improvements in, 605
Glover's patent improvements in warp net fabrics, 430
Glue, marine, 511
Gold and silver, Ashbury's improvements in washing and amalgamating, 234
—— watch-cases, the standard of the, 488
Gorgon, H.M.S., salvage of, Commander Key's "Narrative," 206
Grain-sifter and polisher, Deane, Dray and Deane's, 228
Grannis' improvement in the blacksmith's tuyere, 460
Gravities, specific, 462
Greenfield's coal-cellar plate, 505
Griffin's treatise on the "Dynamics of a rigid body," (review,) 596
Groups, vanishing, on the process of, by James Cockle, Esq., M.A., Barrister-at-law, 504

Gun-cotton, 559
———— engine, Mr. Fox Talbot's patent, 20
———— ———, Mr. Coathupe's improvements in, 213
Gunpowder canisters, metallic, 600
Gutta percha patents, No. VIII., Charles Hancock's, 10th Feb., 1847, 157

Hancock's, Mr. Charles, patent improvements in gutta-percha, 157
Hand, artificial, by Sir George Cayley, Bart., 381
Hands, clean and soft, 463, 536, 600
Hart's patent machine for lasting boots and shoes, 460
Harvey's patent for cutting wooden screws, 237
Hatcher's patent improvements in electro-telegraphy, 357
Hawkins' patent clip, 276
Heat, on the employment of, as a motive power, 350, 374, 399, 434, 446, 534, 543, 581, 598
——, on the contraction and expansion of bodies by, by Wm. Dredge, Esq., C.E., 405
—— and light, analogy between, 549
Heating, Braithwaite's patent improvements in, 217
Helve, steam, 559
Henson, H. H., Esq.; break of buffers not a consequence of break of gauge, 204
Hibson's patent trunks, 67
Hides, Welty's improvements in breaking, fleshing, and unhairing, 460
Holmes and Springer's patent improvement in steering-wheels, 461
Horæ Algebraicæ, by Jas. Cockle, Esq., M.A., Barrister-at-law, 13, 134, 150, 306, 331, 409
Horological tell-tale, Sharp's, 551
Horsley's patent improvements in preserving animal and vegetable substances, 631
Hosiery, Clarke and Barber's improvements in pressing, oiling, &c., 396
Houses, patent improvements in electro-telegraphy, 68
Hunt's, Mr., new division of the sun's rays, 457
Hydraulic engine, Walker's, 91
Hygrometer, Simmons's portable, 12

Ice mountain, 213
—— saw, 607
Indicator and dynamometer, Main and Brown's Treatise on (review), 528
Indeterminate coefficients, and Bernoulli's numbers, on, by Professor Young, 574
Industry, national, necessity of inquiry into the state of, 452
Inglis, Sir Robert, Bart., address by, to the British Association, 17
Inquiries, and answers to inquiries, 462, 487, 535, 547, 606
Inventions, calendar of specifications of patent, 93, 117, 140, 165, 189, 212, 238, 260, 286, 556
Iron, Winslow's patent process of manufacturing, 236

Digitized by Google

Iron, cast, chilled and unchilled, Bowman's experiments on the relative strength of, 520
——, malleable, Blewitt's patent improvements in, 552
—— tubes, manufacture of, 584
——, Vicker's patent improvements in the manufacture of, 631

Jacquard frame, Perrin's patent, 236
Jacot's patent improvement in the escapement of watches, 461
Jager's, Dr., patent improvements in fire-arms and cartridges, 419
Johnson, Professor, on the use of anthracite in locomotives, 411
Jointing and laying glass tubes, method of, 57
Joyce's stove, 559
Judd's patent improvements in windmills, 234

Key's Commander), Narrative of the Recovery of H.M.S. Gorgon, 209
Kirkman, Rev. S. P., reply to Mr. W. S. B. Woolhouse, on certain mathematical prize questions, 92
Kœnig's printing machine, on the introduction of, 355
Korbez, Mr. George, short method by, of determining the slopes of railway cuttings, 430

Lake, lowering a, 559
Lamps, signal, lighting by electricity, 44
——, spring pressure fountain, Wilkins' patent, 1
Lands, poor, Bryant and Tothill's method of rendering arable, 491
Larrard's patent improvements in bobbin-cutting machinery, 606
Lasting boots and shoes, Hart's machine for, 460
Law's patent improvements in yarns and yarn-spinning machinery, 539
Lead, white, or carbonate of, Gannal's new process of manufacturing, 257
Leather trade of the United States, 435
Legendre's theorem for the reduction of a spherical triangle to a plane triangle, proof of, 573
Lester's patent machine for shaving and jointing staves for barrels, 235
Life-preserver and swimming belt, Ayckbourn's 334
Life and property-preserver, marine, Capt. Geo. Smith's, 502
Light and heat, analogy between, 549
——, under the action of magnetism, on, by James Cockle, Esq., M.A., Barrister-at-law, 575
Lighting, Braithwaite's patent improvements in, 217
—— by electricity, Staite's patents for, 44, 462
Linear equations, on the elimination of, by Professor Young, 424
Linen yarns, bleached, drying of, 558
Lithographic printing press, Smart's patent, 589
Loam moulder's crane, Bell's, 204
Lock, permutation, 535
Longitude determination of, by the magnetic telegraph, 311
Looped and woven fabrics, Clarke and Barber's patent improvements in, 395
Lowthorp's lock gate, improved by J. MacGregor, Esq., 136
Lubricator, Stubbs' improved, 575

MacGregor, John, Esq.; new one-fluked anchor, 11; yacht sailing, 61, 153, 244; Lowthorp's lock gate, improved, 136; can a rocket ascend in vacuo? 148; traveller's coffee-pot, 550
Mackinnon's permutation lock, 535
Magic mirrors, 22
—— squares, 506
Magnetic attraction of mud, 180
Magnetism, light, under the action of, on, by James Cockle, Esq., M.A., Barrister-at-law, 575
Magnets, artificial, improved mode of making, by W. Walker, Esq., 408
Main and Brown's Treatise on the indicator and dynamometer, (review,) 528
Mechanical vibration, chemical action arrested by, 608
Malleable glass, Schönbein's, 70, 223
—— iron, Blewitt's patent improvements in, 552
Mallet, Robert, Esq.; methods of jointing and laying glass tubes, 57; patent axle bearings, 180
Manures, artificial, Brown's patent, 200
Marine life and property preserver, Capt. Geo. Smith's, 502
—— glue, 511
Marsh, Mr. James, the late, 558
Mathematical knowledge, on the use of, to engineers, 4, 31, 197, 230, 245, 340
—— prize questions in the Lady's and Gentleman's Diary, 40
—— exercises, 488
Mathematics of phrenology,—Gen. Tom Thumb, 434
"Maxims, Architectural," Professor Donaldson's, 224
May's patent improvements in ploughs, 234
"Mechanics," Weisbach's, (review,) 494
Meerschaum-pipes, how to cleanse, 461
Menai Straits, the, Britannia tunnel-bridge over, 176
Microscopic philosophizing, cursory observations on, 126
Millholland's spark-arrester, 65
Millard's patent water-wheels, 236
Mining, timber, in America, 179
Mirrors, magic, 22
Morse's patent improvements in electro-telegraphy, 68
Motion, perpetual, 463
Motive power, on the employment of heat as, 350, 374, 399, 434, 446, 535, 543, 581, 598
Moulder's (loam) crane, 204
Moulding and casting, Darling's patent improvements in, 605
Moy's double-cylinder safety-valve, 358
Mud, magnetic attraction of, 180
Murray, J., Esq., simple timepiece, invented by, 600

National industry, necessity of an inquiry into the state of, 452
Navigating against the wind, 213
Neptune, the planet, American observations of, 250
Newton, Sir Isaac, monument to, 381
Northampton Agricultural Meeting, 113
Numbers, remarkable properties of, 63

Ohio, the, wire bridge over, 511
Oil, whale, Fitzsimmon's process for purifying, 67
—— and water experiment, Franklin's, 548
Olney's patent improvements in the valves of steam-engines, 460
Organ, piano 70
—— pipes, 487
—— electric, by H. Clarke, Esq., 545
Oscillating can, Fielden's patent, 515
Oxley's, Mr. Thomas, remarks by, on calculating the power and expansion of steam, on board the Washington steamer, 280

Painters' brushes, 535
Paper-cloth, Chapman's transparent, 536
——Schönbein's improvements in, 223
Paris, new "Pont aux Doubles," at, 555
Parallelogram of forces, notes on the demonstration of, in the translation of Poisson's Mechanics, 38, 115
Parsey's compressed-air company, 536
Partridge and Penang canes, 213
Patent inventions, calendar of specifications of, 93, 117, 140, 165, 189, 212, 238, 260, 286, 555
Patent law cases, (American) Smith and Sloat *v.* Mercer and Pechin, 79; Croll *v.* Edge; Beard *v.* Egerton and others, 45
Patents, American, cost of, to British subjects, 67
—— recent, 67, 234, 459
—— New, English, 22, 46, 70, 94, 118, 143, 167, 214, 239, 262, 286, 320, 344, 367, 391, 417, 439, 464, 488, 511, 536, 560, 584, 608, 632
—— New, Scotch, 22, 118, 214, 367, 391, 439
Peale, Franklin, Esq., on balances, 301
Pen or pencil case, Bagley's patent, 459, 460
Permutation lock, Mackinnon's, 535
Perpetual motion, 463
Perrin's patent Jacquard frame, 236
Photography, improvements in, 511
Phrenology, mathematics of—Gen. Tom Thumb, 434
Philosophica Tiransactions, on the physiological papers in, 126
Philosophizing, microscopic, cursory observations on, 126
Phonetic system, and the electric-telegraph vocabulary, 155
Piano, organ, 70

Digitized by Google

Piers, skew, and iron girders, 132
Pipes, meerschaum, how to cleanse, 461
——— organ, 487
Pipes, smoking, 61
———, blast, of locomotive engines, 549
Pitter, James, Esq., archimedean balloon, 64. 149, 243
Planet, a new, to which the French make no claim, 510
Plating, electrotype, 488
Ploughs, May's patent improvements in, 234
———, transposing, Bryant and Tothill's patent, 491
Plus and minus puzzle, 475, 509, 510, 530
Pont aux Doubles, at Paris, 555
Poole's patent improvements in electro-telegraphy, 41
Poisson's mechanics, the demonstration of the parallelogram of forces in, 38, 116
Pooley's patent improvements in weighing machines, 611
Preceptors, college of, 107
Premiums, effect of, 65, 137
Preserver, marine, life and property, Captain George Smith's, 502
Preserving and preparing wood, bricks, tiles, &c., Cox's patent improvements in, 600
——— animal and vegetable substances, Horsley's method of, 631
Press, power of the, 214
Printing press, A. B. Taylor's improved, 67
———, lithographic, Smart's, 589
———, steam, and the "Times," 272, 355
Projectiles, new method of ascertaining the velocity of, 275
Propellers, submerged side, Simpson's, 443, 463, 527
Propelling, Echol's patent method of, 235
Pump, spray, Adcock's patent, 45, 256, 285, 315, 343, 366, 414, 500, 531, 552
Puzzle, plus and minus, 475, 509, 510, 530

Race's patent self-acting register for stoves, 67
Raft, large, 190
"Railway locomotion and steam navigation," Curr's, (review,) 335, 438
Railways: explosion of an American locomotive, 84; prevention of accidents, 222, 327, 366; buffers, 20, 43, 139, 249, 275, 274, 371, 461, 486; Doull's signals, 145; break of buffers not a consequence of break of gauge, 204; Mr. R. Stephenson's report on the double gauge, 187; Mr. George Stephenson's break, 274; Tibbit's break, 371; Rowland's signals, 310, 543; Stevens' patent signals, 323; safety telegraph, 330; Staite's mode of lighting signal lamps by electricity, 462; Saunders and Bisset's patent tyre, 461; Korbez's short method of determining the slopes of cuttings, 430; friction considered in respect to drawing and drawn carriages, 432; Samuel's express engine, light engines for light weights, 455; the mixed gauge, 453; Winans' improved locomotive, 461: Taylor's improvements in engines and carriages, 583; communication between drivers and passengers, 486, 558; atmospheric system, 214, 260, 457; Cunningham and Carter's, 283; Tyler's patent switches, 235; suggestions for the safer construction of railways, 115
Rain ng upwards, 416
Rathen's, (Baron,) compressed air locomotive, 93
Reeds, metallic, Shaler's patent improvements in, 234
Register stoves, self-acting, Race's, 67
Remington's aerial bridge, 259
Rifle-ball, the, motion of, 535
Roads, common, steam carriages on, tolls levied on, 462
Rochdale, boiler explosion at, 456
Rock and Sons' patent duplex chariot, 347
Rock, Mr. James, Junr., on railway buffers, 273; on the causes of the fracture of axles, 624
Rockets, Congreve, 559
———, can they ascend in vacuo? 131, 148
Roman cement, 487
Ropes, wire, historical notice of, 462
Rose's domestic telegraph, 359
Rosse, telescope, the, 66
Rowland, Mr. Owen; improvements in railway buffers, 139, 249; method of ascertaining the velocity of projectiles, 275; railway signals, 310, 543
Rutherford and Sibley's "earthwork tables," (review,) 138, 191

Safety valve, double cylinder, Moys, 358
Salute, novel, 214
Samuel's railway express engine, 455
Sanatory measures, Ellerman's antidote, 631
Saunders and Bisset's patent tyre for railroad wheels, 461
Saw-mill saws, Spencer's patent for recutting the teeth of, 460
Scales, self-acting, Athey's, 382
———, boiler, experiments on, 554
Schoenbein's malleable glass, 70; improvements in paper, 223
Scouring and bleaching, Brooman's patent improvements in, 563
Screw guard ship "Blenheim," 458
———, Archimedes, 557
Screws, wooden, Harvey's patent for cutting, 237
Sewer trap, Abate's, 20
Shaler's patent improvements in tuning metallic reeds, 234
Sharp's horological tell-tale, 551
Ship building, an old French experiment in, 90
Ships, F. B. Steven's patent improvements in, 604
Shuldham, Com., R.N., on yacht sailing, 175, 429
Sibley and Rutherford's "earthwork tables," (review,) 138, 191
Signal light, cheap, 213
Signals, railway and steam-boat, Doull's patent, 145
———, Rowland's, 310, 543
———, Stevens's, 323
Silk, solution of, 463
Silver, Ashbury's improvements in washing and amalgamating, 234
Simmons's portable hygrometer, 12
Simpson's patent submerged side propellers, 443, 463, 527
Skew piers and iron girders, 133
Slopes of railway cuttings, Korbez's short method of determining, 430
Smart's patent lithographic printing press, 589
Smith and Sloat, v, Mercer and Pechin, (American patent law case,) 79
Smith's (Captain George,) marine life and property preserver, 502
"Solutions of trigonometrical questions," by Rev. Thomas Gaskin, M.A., (review,) 436
"——— of geometrical problems," by ditto, (review,) 619
——— of silk, 463
Spanners, 535
Spark arrester, Milholland's, 65
Specific gravities, 462
Spencer's patent method of recutting the teeth of saw-mill saws, 460
Specifications of patent inventions, calendar of, 93, 117, 140, 165, 189, 212, 238, 260, 286, 556
Spray pump, Adcock's, 45, 256, 285, 315, 343, 366, 414, 500, 531, 552
Squares, magic, 506
Staite's patent for lighting by electricity, 44, 462
Stars, new cluster of, 190
——, the, no present proof of the existence of, 213
Staves for barrels, Lester's machine for shaving and jointing, 235
Steam, poetry of, 275
Steam-boat, explosion, 214, 316, 343
———, new, for canals, 584
Steam-engine, the: Bourne's "Catechism," (review.) 476; Craddock's patent improvements 97, 121, 156, 169, 265, 308, 380; prize competition at Northampton for the best portable engine, for farming purposes, 113; causes of explosions, 84, 547; Fossick, Hackworth and Elliott's tubular boilers, 241; how to calculate the power and expansion of steam, 280; blast pipes, 549; Taylor's improvements, 583; commercial mode of calculating the power of, 558; Olney's improvements in valves, 460; use of anthracite in locomotives, 411; Stephenson's long bodied engines, 343; Stephenson's three cylinder engine, 92; condensation by external application, 173
———, American, 252, 559
Steam helve, 559

Digitized by Google

Steam printing and "The Times," 272, 355
—— vessels: Blenheim, screw guard ship, 458; Courier, 459; Cricket, explosion of the, 214, 316, 343; Express, 46; Gorgon, H.M.S., wreck and recovery of, 209; Great Britain, wreck and recovery of, 206, 232, 253, 256; Hendrick Hudson, 559; Inflexible, 361; Sarah Sands, 608; Vassitei Tidjaret, 46, 259; Washington, 280
Steamers, river, necessity for a periodical survey of, 366
Steele, Thomas, Esq., proposition by, for monument to Newton, 351
Steering wheels, Holmes and Springer's improvements in, 461
Stephenson's, Mr. George, railway break, 274
Stephenson, Robert, Esq., C.E.; three cylinder engine, 92; long bodied engine, 243; report on the double gauge, (review,) 187
Stevens's patent railway signals, 323
———, F. B., patent improvements in ships, 604
Storms, effect of, 183
Stoves, self-acting register for, Race's, 67
———, Joyce's, 559
Stubbe' improved lubricator, 575
Sugar, on the extraction of, from the cane, by H. Crosley, Esq., 311
Sun, rays of the, Mr. Hunt's new division of, 457
Suspension wire bridge over the Ohio, 190
Sutton, Mr. John, on the safer construction of railways, 115
Swan's new solution for magnetic batteries, 70
Swimming-belt and life-preserver, Ayckbourn's, 334
Switches, railway, Tyler's patent improvements in, 235
Table, dear, 213
Talbot's, Mr. Fox, gun-cotton engine, 20
Tapestry carpeting, American, 458
Tayler, Richard, Esq., on the introduction of Kœnig's printing-machines, 855
Taylor's, A. B., printing presses, 67
———, George, patent improvements in locomotive engines and railway carriages, 583
Teeth of saw-mill saws, Spencer's patent for recutting, 461
Telegraph, domestic, Rose's, 859
———, for railway trains, 330
———, electric, 330, (*see Electro-Telegraphy.*)
Telescope, the Rosse, 66
Tell-tale, Sharp's horological, 551
Theory and practice, 464
Thumb, General Tom, 434
Tibbit's patent railway break, 371
Tides, atmospheric, 17
Tilke's national economic bath, 228
Timber mining in America, 179
———, Von Schmidt's patent method of impregnating, 460
Time, true, communication of, 183
Time-piece, simple, 600
"Times" and steam printing, 272, 355
Tolls on common road steam carriages, 462
Tool holders, 608
Tortoise-shell bonnet, 213
Transparent paper-cloth, Chapman's, 536
Transposing plough, Bryant and Tothill's patent, 491
Trap, sewer, Abate's, 20
Tremblay's ether engine, 599
Triangle, spherical, proof of Legendre's theorem for the reduction of, to a plane triangle, 573
"Trigonometrical questions, Solutions of," by Rev. Thomas Gaskin, M.A., 436
Trunks, Hibson's patent, 67
Trussing beams and girders, Gibbon's patent improvements in, 455
Tubes, glass, method of jointing and laying, 57
———, iron, manufacture of, 584
Tunnel, iron, Britannia, over the Menai Straits, 176, 428; safe mode of raising, 486
———, over the Conway, 423
———, under the St. Lawrence, 214
Turn-tables, Brooman's patent, 437
Tuyere, blacksmith's, Grannis's patent improvements in, 460
Tyler's patent improvements in railway switches, 235
Type, metal, Warren's patent substitute for, 69
Tyre for railroad wheels, Saunders and Bisset's patent, 461

Ure, A., M.D., on Field's ebullition alcoholmeter, 479
Utility, Articles of, registered, lists of, 23, 47, 71, 95, 119, 143, 167, 191, 215, 239, 262, 287, 320, 344, 368, 392, 417, 439, 464, 488, 512, 536, 560, 585, 609, 632

Vacuo, in, could a rocket ascend? 148, 176
Vacuum, Nature's abhorrence of, 558
Valve, safety, Moy's double cylinder, 358
Valves of steam-engines, Olney's patent improvements in, 460
Vanishing groups, on the new method of, by James Cockle, Esq., M.A., Barrister-at-law, 505
Vegetable substances, Horsley's mode of preserving, 631
Vegetables, etherization of, 22
Velocity of electric currents, 256
———— projectiles, method of ascertaining, 275
Ventilating, Braithwaite's patent improvements in, 217
Ventilation, on, by Wm. Dredge, Esq., C.E., 628
Vicker's patent improvements in the manufacture of iron, 631

Walker's hydraulic engine, 91
Walker, W., Esq., R.N., improved mode of making artificial magnets by, 408
Waller's patent coffee-pot, 478
Walls, retaining, on the construction of, 576
Warp net fabrics, Glover's patent improvements in, 430
Warren's patent substitute for type metal, 69
Watch escapements, Jacob's patent improvement in, 461
Water, force of wind on bodies of, 558
———, power obtainable from the decomposition of, 65
———, weight of, at great depths, 536
—— wheels, Millard's patent, 236
—— works, rendered subsidiary to the extinction of fires, 516
Weaving, works on, 488
Weighing machines, Pooley's patent improvements in, 611
Weisbach's Mechanics, (review,) 494
Welty's patent improvements in breaking, fleshing, and unhairing hides, 460
Wenman's patent filtering cock, 67
Whale-oil, Fitzsimmon's patent process for purifying, 67
Wheels, railroad, Glasco's patent, 68
————, tyre for, Saunders and Bisset's, 461
—— steering, Holmes and Springer's, 461
Wilkins and Co.'s patent spring pressure fountain lamps, and diagonal gas-burners, 1
Wilkinson, Thomas, Esq.; expression for acceleration simplified, 209; the plus and minus puzzle, 509.
Winans' improvements in locomotive steam-engines, 461
Wind, force of, on bodies of water, 558
———, the, navigating against, 213
Windmills, Judd's improvements in, 234
Winslow's patent process for manufacturing iron, 236
Wire-rope suspension bridge, 190
Witford, Mr. John, short methods in gauging by, 426
Woolhouse, W. S. B., Esq., on certain mathematical prize questions, 40, 92
Wood, bricks, and tiles, Cox's patent improvements in preserving and preparing, 600
Woven & looped fabrics, C. Clarke and Barber's patent improvements in, 395
Wrigg's patent self-carrying railway carriage, for common roads, &c., 194

Yacht sailing, by J. MacGregor, Esq., 61, 153
————, by Commander Shuldham, R.N., 175, 429
Yarns and yarn-spinning machinery, Law's patent improvements in, 539
——, bleached linen, drying of, 558
Yates' patent blast furnaces, 20
Young, Professor; the diminution of linear equations, 424; simple investigation of the exponential theorem, 546; indeterminate coefficients, and Bernoulli's numbers, 574, 627

Zinc perforated plates, 608

Digitized by Google

ALPHABETICAL LIST OF NEW PATENTS GRANTED FOR ENGLAND, SCOTLAND, AND IRELAND.

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Bacon and ano..	Steam-engines	19 Aug.	17 Sep.	5 Oct.	214—391
Bailey	Knitted fabrics	6 Aug.	....	....	167
Bain.....	Electro-telegraphy.....	....	....	21 June	
Bain.....	Playing on musical instruments	7 Oct.	....	....	367
Baines	Railways and bearings ..	29 July	....	....	118
Baird	Communication.....	22 Dec.	....	....	632
Baker	Steam-boiler furnace....	22 Dec.	....	....	632
Bakewell	Soda-water.....	11 Nov.	....	....	488
Banks	Curing coffee.....	21 Oct.	....	....	417
Baranowski	Ready-reckoning machine	19 July	....	1 Nov.	94
Baranowski	Ready-reckoning machine	11 Nov.	....	....	488
Barber.....	Propelling	7 Oct.	....	....	367
Barker.....	Manure	26 Oct.	....	....	439
Barratt.....	Agriculture	25 Nov.	....	....	536
Barros.....	Sustaining gun-stocks,&c.	30 Sep.	....	....	344
Bassaume	Printing.....	7 Oct.	....	....	367
Battye.....	Retaining the waist of the body in a desirable form, without inconvenience resulting from too tight lacing.....	9 Sep.	....	....	262
Beale	Anchors.....	13 July	....	....	71
Bell	Mineral paint.....	23 Sep.	....	....	320
Beniowski	Printing	14 Oct.	....	....	392
Bessemer.....	Glass	17 July	....	....	94
Betts and ano. ..	Capsules.....	30 Nov.	....	....	360
Birchall	Folding newspapers.....	5 Aug.	16 Aug.	....	143, 214
Birkmyre.....	Smelting	16 Nov.	....	....	511
Blewitt.....	Iron.....	....	24 May	....	22
Blyth and others	Distilling and rectifying .	9 Sep.	23 Aug.	....	262—367
Boulnois	Draught harness	2 Nov.	....	....	464
Bowra	Colouring matters.....	19 Aug.	....	....	214
Bourne.....	Kilns	4 Aug.	....	....	143
Boyle	Buttons	4 Aug.	....	....	143
Brett and ano...	Electro-telegraphy	....	15 June	....	22
Breynton.....	Rotary steam-engines ...	....	21 July	....	118
Britten	Cooking.....	8 Dec.	....	....	584
Broadbent	Paper.....	5 Aug.	21 July	16 Oct.	143, 118
Brockedon	Heating rooms.....	9 Sep.	....	....	262
Brooman	Metals.....	....	....	20 Oct.	
Brooman	Turn-table.....	....	....	23 Oct.	
Brothers	Retorts.....	19 Aug.	....	....	214
Brown	Iron.....	3 July	....	....	46
Brown, Sir Samuel.....	Propelling, steering, & mariners' compass ..	7 Oct.	....	....	367
Brunton	Dressing ores.....	16 Nov.	....	....	511

Digitized by Google

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Bursell and ano..	Envelopes	6 Nov.	....	....	488
Card.....	Cords, bands, twines....	....	28 Sep.	....	439
Carey	Infusions and extracts...	26 Oct.	....	....	439
Carr.....	Looms.....	3 July	....	....	47
Carter	Crushing flax.....	....	16 Aug.	....	214
Ceal and another	Tobacco.....	28 July	....	....	118
Chabot.....	Railway carriages	2 Sep.	....	....	239
Chandler.....	Liquid manure	1 Dec.	....	....	360
Chaplin	Wheels.....	29 June	....	....	22
Chesterman	Tape measures.....	13 Nov.	....	....	511
Chinnock....	Regulating motion and controlling friction..	....	3 Sep.	....	391
Claeys and ano..	Cork.....	3 July	....	....	47
Claypole	Sugar.....	9 Nov.	....	....	408
Coad.....	Fuel	25 Nov.	....	....	536
Coulton	Propelling	2 Nov.	....	....	464
Craddock.....	Steam-engines and boilers	....	23 June	....	118
Craig and ano...	Power-looms.....	....	....	16 Oct.	
Crampton	Locomotive steam-engines	....	15 June	....	22
Curtis	Spinning	14 Oct.	....	....	392
Dakin.....	Coffee.....	8 Dec.	....	....	584
Darling.....	Iron.....	....	23 June	....	118
Davison & ano..	Desiccating processes	6 Nov.	....	....	404
Davy	Ores	2 Sep.	....	....	239
De Bergue ...	Buffing and traction apparatus	26 July	....	1 Nov.	118
Dickenson	Paper.....	23 Sep.	....	....	320
Dodge	Spinning & winding yarn	7 Oct.	27 Sep.	....	367, 439
Dujardin	Electro-magnetic telegraphy.....	7 Oct.	....	....	367
Du Molay ...	Inlaying and coating metals	4 Nov.	....	....	464
Dunn	Railway wheels and axles	2 Nov.	....	....	464
Durafour.....	Lacing.....	4 Nov.	....	....	464
Eaton.....	Preventing railway accidents.....	19 Aug.	....	....	214
Eaton.....	Raising water.....	19 Aug.	....	....	214
Eaton.....	Twisting cotton, &c.	1 Dec.	....	....	560
Eiffe.....	Chronometers	8 Dec.	....	....	584
Ellerman	Disinfecting and deodorising processes	7 Oct.	....	....	367
Evans.....	Wheels.....	28 Oct.	....	....	439
Farries.....	Propelling	19 Aug.	....	....	214
Fell and ano....	Motive power.....	7 Oct.	....	....	367
Ferryman	Handles.....	6 Sep.	....	....	262
Fletcher.....	Specula	3 Aug.	....	....	143
Fielder.....	Iron beams and girders..	9 Nov.	....	....	488
Fisher	Boots and shoes.....	14 Oct.	....	....	392
Fontainemoreau	Preparing cotton	17 July	13 Sep.	20 Oct.	94—391
Fontainemoreau	Cutting wood and veneers	....	11 Aug.	....	214
Fontainemoreau	Steam and other engines	....	31 Aug.	....	367
Fontainemoreau	Braids.....	18 Nov.	....	....	512
Fontainemoreau	Tubes.....	18 Nov.	....	....	512
Forster.....	Gutta percha	21 Oct.	....	....	417
Foster	India rubber.....	2 Sep.	....	....	239
Fourmentin....	Carbonate of lead.....	....	28 May	....	22

Digitized by Google

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Galloway	Rotary engines	....	11 June	....	22
Gard	Boring and sinking	21 Oct.	....	....	417
Gibbons	Trussing-beams & girders	9 Sep.	....	....	262
Gougy	Moving heavy bodies	....	16 June	....	23
Gray	Gas-meter	....	....	27 Sep.	
Hackett	Pill-boxes	8 Dec.	....	....	585
Hancock (W.)	Bolts, locks, & fastenings	16 Sep.	....	....	287
Hancock (C.)	Gutta percha	24 Sep.	26 Aug.	10 Aug.	320—367
Hancock (Thos.)	Elasticated fabrics	2 Nov.	....	....	464
Harradine	Agriculture	14 Oct.	....	....	391
Hartley	Glass	7 Oct.	....	....	367
Hastie	Motive power	29 July	....	....	118
Healey	Weaving	....	15 June	....	22
Heaton	Locomotive engines	9 Nov.	....	....	488
Hedge	Rails	....	22 July	2 Aug.	118
Heesman	Thrashing-machine	17 July	....	....	94
Heason	Razors	17 July	....	....	94
Hill	Producing musical sounds	28 June	....	....	22
Hill	Looms	....	9 June	....	22
Holgate	Power-looms	25 Nov.	....	....	536
Holland	Applying manure	....	20 Aug.	....	214
Hornblower	Motive power	28 June	....	....	22
Horne	Carriage windows	14 Sep.	....	....	391
Huddart	Agriculture	3 July	7 June	....	22—46
Hunt	Light	3 July	....	....	46
Hutchinson	Pasteboard	25 Nov.	....	....	536
Hutchison	Hardening and polishing stone	....	12 Oct.	2 Nov.	439
Jay	Evaporating and concentrating saccharine and saline solutions	30 Sep.	....	....	344
Jayet	Calculating machines	28 Oct.	....	....	439
Johnson	Refining silver lead	23 Sep.	6 Sep.	....	320—391
Johnson	Wire-cloth	30 Sep.	....	....	344
Johnstone	Sugar	....	21 July	....	118
Jones	Steam-engines and propellers	29 July	....	....	118
Kenrick	Moulds	....	18 June	....	23
Kinsman	Rotary engines	11 Nov.	....	....	488
Kirrage	Building	22 Oct.	....	....	439
Knowelden	Steam-engines	....	30 June	....	118
Kurtz	Indigo	9 Sep.	29 June	....	118—262
Kurtz	Dyeing and printing	....	29 June	....	118
Laming	Coal gas	4 Nov.	....	....	464
Lane	Railway carriages and engines	....	11 June	8 Sep.	22
Lane	Railway carriages and engines	....	4 Oct.	....	439
Langton	Knitted fabrics	2 Nov.	....	....	463
Larrard	Cutting bobbins, &c.	....	15 June	....	22
Law	Yarns	....	13 July	....	118
Lawson	Cleaning wool	4 Nov.	....	....	464
Leadbetter & ano	Raising fluids	6 Sep.	....	....	262
Leatham	Roving and spinning	....	24 May	14 Aug.	22
Lewthwaite	Numbering machines	23 July	....	....	94
Light	Buoying	19 July	....	....	94

Digitized by Google

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Lignac	Preserving milk	7 Oct.	8 Sep.	....	367—391
Lillie, Sir J. S.	Agriculture	14 Oct.	....	....	391
Lister and ano.	Carding	7 Oct.	....	....	367
Livingstone	Colouring matters	23 Aug.	....	....	214
Lloyd	Tobacco	14 Oct.	....	....	392
Longmaid	Alkali and chlorine	2 Nov.	....	....	463
Low	Metals	4 Nov.	....	....	464
Mackintosh	Motive power and propelling	....	6 Aug.	....	214
Madigan	Railway turntables	2 Sep.	....	....	239
Maltby	Spirits	15 Dec.	....	....	608
Manlove	Propelling	....	31 Aug.	....	367
Mansfield	Light	11 Nov.	....	....	488
Mapple & others	Electro-telegraphy	....	2 Aug.	26 July	214
Marsden	Dressing wool, flax, &c.	6 Sep.	....	....	262
Martin	Drain-tiles	18 Nov.	....	....	512
Maudslay	Candles	14 Oct.	....	....	392
Meyer	Umbrellas and parasols	2 Oct.	....	....	464
Michant	Heating	15 Dec.	....	....	608
Miller	Lamps	3 July	....	....	46
Mitchell	Docks	3 July	....	8 Sep.	46
Moenck	Clocks	1 Dec.	....	....	560
Mollett	Fire-arms and cartridges	....	21 Sep.	28 Oct.	391
Moore	Looms	30 Sep.	....	....	344
Morewood & ano.	Sheet-iron	....	7 June	....	22
Morison	Propelling	29 July	18 Aug.	....	118—214
Mowbray	Looped fabrics	1 Dec.	....	....	560
M'Sweeny	Steering	....	7 Oct.	....	439
Murdoch	Capsule	2 Nov.	....	....	464
Napier	Smelting	....	7 Oct.	....	439
Neville	Conveyance	21 Oct.	....	....	417
Newall	Locomotive engines	....	6 Aug.	....	214
Newall	Grinding	14 Oct.	21 Oct.	....	392—439
Newton	Wheels	28 June	....	....	22
Newton	Steam boilers	....	11 June	....	22
Newton	Railway engines and carriages	13 July	....	....	71
Newton	Screws	12 July	....	....	70—118
Newton	Kiln and oven	29 July	....	....	118
Newton	Spinning and doubling	23 Sep.	....	....	320
Newton	Nets and netting	30 Sep.	....	....	344
Newton	Buildings and furniture	7 Oct.	....	....	367
Newton	Blooming iron	14 Oct.	....	....	392
Newton	Pigments	16 Nov.	....	....	511
Nicholls	Distributing corn & grain	30 Sep.	....	....	344
Nicoll	Packets, bags, &c.	....	19 July	11 Aug.	118
O'Leary	Producing power	9 Sep.	....	....	262
Orland	Dyeing & metallic alloys	2 Sep.	....	....	239
Parker	Cigars	29 July	....	....	118
Parkes	Metals	18 Nov.	....	....	512
Paul	Agriculture	29 July	....	....	118
Pearson	Locomotive engines & carriages	7 Oct.	....	....	367
Pecqueur	Leather	....	....	26 July	
Pedder	Propelling	6 Nov.	....	....	464
Perlback	Metals and alloys	23 July	....	....	94

Digitized by Google

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Petrie	Electro-telegraphy	26 Oct.	....	....	439
Philippi	Stretching & finishing woven fabrics	....	23 June	24 July	23
Phillips	Purification of oils	16 Nov.	....	....	511
Pidding	Vegetable extracts	....	1 Sep.	....	391
Pierpoint	Light	7 Oct.	....	....	367
Pitt	Holding down trousers	9 Sep.	....	....	262
Platt & ano.	Manufacture of cards, & for preparing, spinning, & weaving cotton, &c.	24 July	....	....	118
Playfair & ano.	Sugar	21 Oct.	....	....	417
Poole	Metals	....	5 Aug.	....	214
Prelier	Sulphuric acid	29 June	9 July	1 Sep.	22—118
Preston	Preparing cotton	....	21 June	....	23
Pruday	Reducing vegetables & substances to small particles	23 Aug.	....	....	214
Ray	Delivering cargoes	3 July	....	....	47
Rayner	Propelling	23 July	....	....	94
Reid	Electro-telegraphy	23 Nov.	....	....	536
Renard	Preserving & colouring wood	19 Aug.	....	....	214
Reynolds	Hop-poles, hurdles, &c.	19 Aug.	....	....	214
Revington	Dibbling	7 Dec.	....	....	585
Richardson	Sugar	....	....	2 July	
Ridgway	Paste boxes, &c.	21 Oct.	....	....	417
Robertson	Metals	9 Sep.	....	....	262
Robertson	Architecture	9 Nov.	....	....	488
Robertson	Preparation and application of colours	10 Dec.	....	....	585
Rochay	Zinc	22 Dec.	....	....	632
Rocke	Wrought iron	18 Nov.	....	6 Nov.	512
Rose	Wind instruments	6 Sep.	....	....	262
Roose	Welded iron tubes	....	....	26 July	
Ryan	Consuming smoke	28 July	....	....	118
Sabseac	Brassing and bronzing	30 Sep.	....	....	344
Salmen	Substitute for leather, &c.	11 Nov.	....	....	488
Sandeman	Dressing, cleansing, scouring, & bleaching	31 July	....	....	143
Schiele	Steam condenser	....	28 May	....	22
Scoffern	Sugar	8 Dec.	....	....	584
Shaw	Carding, drawing, and slubbing	....	2 June	....	118
Shaw	Wrought iron	21 Oct.	....	....	417
Siemens	Engines	22 Dec.	....	....	632
Sievier	Purifying and decolorizing	12 July	....	....	70
Sievier	Stamping, marking, cutting, embossing, or printing	17 July	....	....	94
Simcox	Carpets	16 Nov.	....	....	511
Sinister	Stays and belts	5 Aug.	....	....	143
Simpson	Propelling	....	2 June	....	22
Sims	Steam-engines	9 Sept.	....	....	262
Slaughter	Locomotive engines	19 July	20 July	....	94—118
Sloman	Ironing	21 Oct.	....	....	417
Soward	Windows	11 Nov.	....	....	488
Squires	Motive power	18 Dec.	....	....	632

Digitized by Google

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Smith & ano. ..	Filtering	21 Oct.	....	....	417
Smith	Determining the pressure of steam	....	30 Sep.	....	439
Staite.....	Lighting	3 July	....	....	47
Stamp	Hats, caps, &c.	22 Dec.	....	....	632
Starr	Protean jet	29 July	....	....	118
Steiner.....	Sugar	9 Sept.	16 Aug.	....	214—262
Stevens.....	Ships and vessels.....	....	9 June	27 Sep.	22
Stevenson	Regulating the generation of steam	....	12 Oct.	....	439
Stokes	Tracing or engraving	10 July	....	....	7
Swinbourne	Gelatinous substances	24 Nov.	....	....	536
Sykes & ano. ...	Cleaning wool, cotton, &c.	17 July	....	....	94
Tall	Setting saws	19 July	....	....	94
Tattersall.....	Communication	21 Oct.	....	....	417
Taylor.....	Railway engines and carriages	....	18 June	....	23
Taylor	Printing	7 Oct.	....	....	367
Taylor	Sweeping chimneys	13 Nov.	....	....	511
Thomas	Stays	26 Oct.	11 Aug.	....	439—214
Tilghman.....	Acids and alkalies.....	....	....	2 Aug.	
Tilghman.....	Alkaline salts.....	....	....	2 Aug.	
Tonge	Glass	3 July	....	....	46
Torrot.....	Time signal	8 Dec.	....	....	584
Townsend ..	Looped or knitted fabrics	7 Oct.	....	....	367
Travis	Looms	25 Nov.	....	....	536
Tuck	Ventilating.....	....	4 Oct.	6 Nov.	439
Turner.....	Roofs and floors.....	....	....	28 June	
Tyrrel	Elastic fabrics	7 Oct.	....	....	367
Vint.....	Propelling	6 Sep.	....	....	262
Vogel	Weaver's harness	....	17 Sep.	....	391
Von Rathen..	Universal wheels, or rotary engines.....	19 July	27 Sep.	....	94—439
Von Rathen....	Motive power.....	2 Nov.	....	....	463
Wall.....	Oxides	14 Oct.	....	13 Nov.	392
Walker	Weaving.....	2 Nov.	....	....	464
Walker	Earthenware and China..	20 Nov.	....	....	536
Wand	Spinning	9 Nov.	....	....	488
Waterhouse..	Railway engines, tenders, and carriages ..	....	....	21 July	
Ward	Motive power, breaks, and signals	2 Sep.	....	....	239
Weare	Clocks	3 July	....	....	46
Webster	Atmospheric buffer	19 Aug.	12 Aug.	20 Oct.	214—214
Wells	Atmospheric signal	4 Nov.	....	....	464
Westhead.....	India rubber	4 Nov.	....	....	464
Wetterstedt....	Sheet metal	....	15 Sep.	....	391
Wheeler	Valves	3 July	....	....	47
White	Gas.....	....	25 Aug.	15 Oct.	367
Whitley.....	Washing, scouring, and dyeing.....	19 July	....	....	94
Wilks	Oil.....	3 July	....	....	46
Wilson, R....	Forging, stamping, & pressing metals	26 June	17 Sep.	....	22—391
Winslow.....	Files and rasps	3 July	12 July	....	47—118
Winter.....	Rope, cord, &c.....	15 Dec.	....	....	608

Digitized by Google

Name.	Subject.	England.	Scotland.	Ireland.	Page.
Wire	Candles	15 Dec.	....	....	608
Witherell	Iron	29 July	....	....	118
Wood	Spinning	....	....	21 Aug.	
Woods	Springs	....	....	26 Oct.	
Wrigg	Diminish draught and friction	....	....	11 Aug.	
Wrighton	Railway carriages and engines	22 Dec.	....	....	632
Wye	Driving piles & raising earth and fluids	7 Oct.	....	....	367
Young	Card cases & paper holders	29 June	....	....	22
Yule	Railway chairs	....	27 July	....	214

Digitized by Google

Digitized by Google

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1247.] SATURDAY, JULY 3. [Price 3d.

Edited by J. C. Robertson, 166 Fleet-street.

MESSRS. WILKINS AND CO.'S SPRING PRESSURE FOUNTAIN LAMPS AND DIAGONAL GAS BURNERS.

Fig. 1.

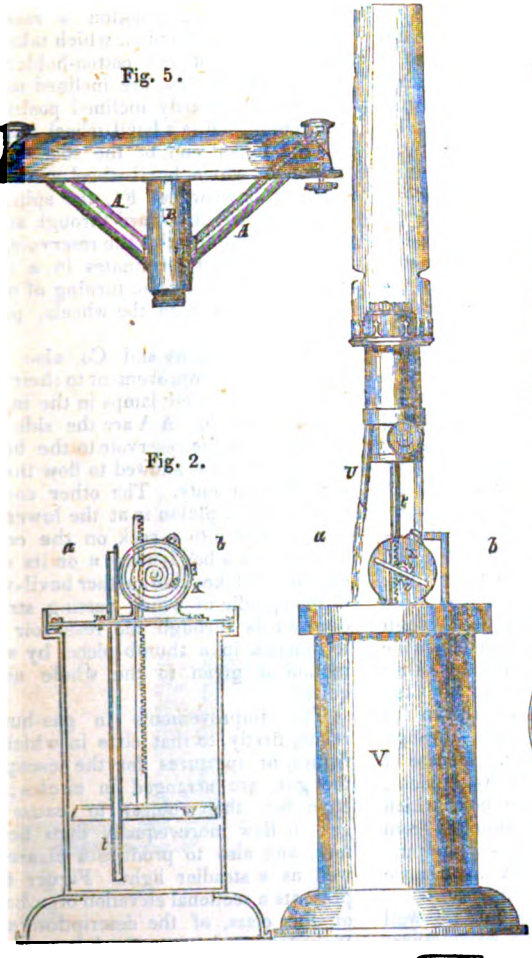


Fig. 5.

Fig. 2.

Fig. 4.

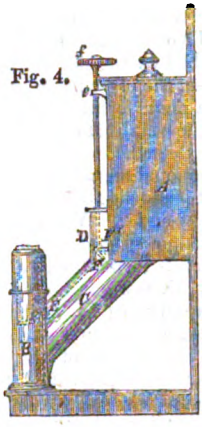


Fig. 3.

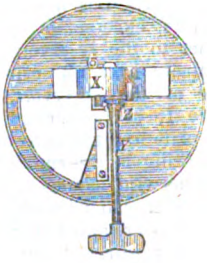
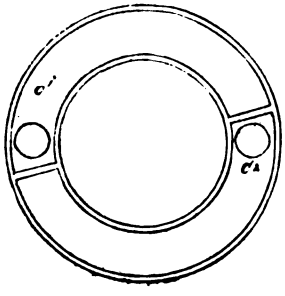


Fig. 7a.



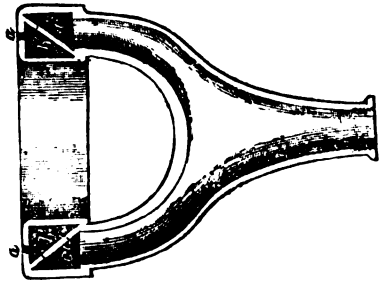


Fig. 7.

Digitized by Google

MESSRS. WILKINS AND CO.'S SPRING PRESSURE FOUNTAIN LAMPS AND DIAGONAL GAS-BURNERS.

AMONGST the latest novelties in lighting (with oil and gas), the articles which form the subject of our present article hold a prominent place.

Two pressure fountain lamps are described by the patentee. In the first of these, the pressure is produced by means of a metallic spring, instead of, as usual, by the weight of the atmosphere. Fig. 1 is an external elevation of this lamp; fig. 2 a sectional elevation of the parts peculiar to it; and fig. 3 a plan on the line *a b* of figs. 1 and 2. V is an oil reservoir; W a leather piston, or plunger, the rod of which is formed with a rack on one side of it; X is a box bolted to the top of the oil-reservoir (V), which contains a coiled spring *s*, the outer end of which is made fast to the case of the box X, and the inner end is connected to the end of a spindle Y, which carries a pinion Z, which takes into the rack on the side of the rod of the piston W. By turning the pinion Z, the piston is raised to the top, or nearly so, of the reservoir V, and the spring *s* at the same time wound up. And as the spring unwinds itself, it gradually forces the rack, piston-rod, and piston downwards, which, in their turn, force up the oil through the pipe *t* into the burner. U is a waste-pipe, through which any excess of oil is returned from the burner to the reservoir. It may either terminate over an orifice in the top plate of the reservoir, as shown in figure 1, or be carried down through that plate into the reservoir. In case of the spring being ruptured by accident, or otherwise damaged, the box, which contains it, can be readily unbolted from the reservoir, and removed, for the purpose of repair, without any disturbance to the other parts of the lamp.

The other fountain lamp is of the wall class, and is distinguished from others in having an arrangement by which the cotton may be raised or lowered without the aid of a stuffing-box, and the possibility of leakage is thereby wholly prevented. A side elevation of a lamp of this kind, as thus improved, is given in fig. 4. A is the fountain or reservoir, which communicates by a pipe C with the burner B. D is a pipe, which is fixed in front of the fountain, and may either extend the whole way up, or only as far as represented in the drawing, and leads off at bottom to the burner at the same angle with and immediately a-top of the oil-pipe C. In this pipe are enclosed the principal parts of the mechanism by which the cotton is raised or lowered. E is a pinion, which takes into the rack E^1 of the cotton-holder, the teeth of which last are inclined so as to suit the necessarily inclined position of the pinion. F is a bevil-wheel, attached to the upper end of the shaft of the pinion E, which bevil-wheel works into another bevil-wheel F^1, the spindle of which is carried upward through an eye-piece *e* in the front of the reservoir, near to the top, and terminates in a milled thumb-piece *f*, by the turning of which, motion is given to the wheels, pinion, and rack.

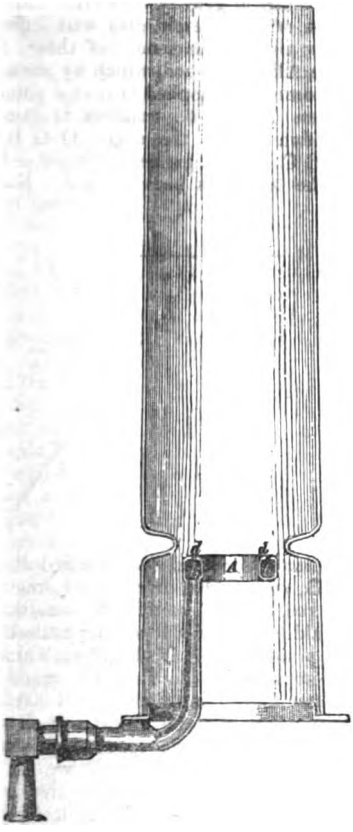
Messrs. Wilkins and Co. also adapt the preceding improvement to their well-known catoptric oil lamps in the manner shown in fig. 5. A A are the side tubes leading from the reservoir to the burner B; but the oil is allowed to flow through one of them only. The other contains a rod with a pinion *m* at the lower end, which takes into a rack on the cotton-holder, and a bevil-wheel *n* on its upper end, which takes into another bevil-wheel *o*, the spindle of which passing straight downwards through the reservoir case, terminates in a thumb-piece, by which motion is given to the whole as required.

The improvements in gas-burners relate, firstly, to that class in which the flames, or apertures for the escape of the gas, are arranged in circles; and have for their object to cause the gas to flow more equally than heretofore, and also to produce a clearer, as well as a steadier light. Figure 6 represents a sectional elevation of a burner of this class, of the description called "shadowless burners." A is an argand burner, and *b* a perforated plate inserted crosswise in the interior of it. Each of the holes in the burner is formed by the junction of two holes drilled in an inclined direction, the one to the other, as commonly done in the boring of the fish-tail burner. The perforated plate *b* serves to check the flow of the gas, and the inclined passages to divide the gas into as many double streams crossing each other at the point of ignition as there are orifices *d d* on the top surface of the burner, whereby a much better

Digitized by Google

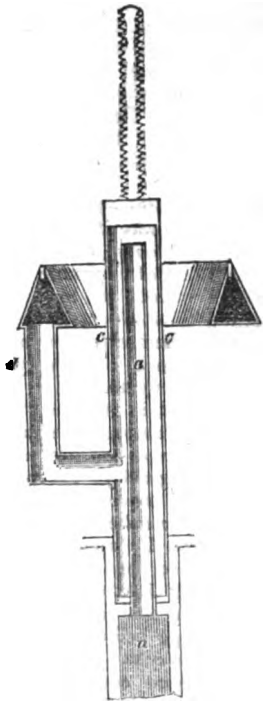
combustion of the gas is effected than would otherwise take place.

Fig. 6.



A second improvement in gas burners consists in the following new arrangements, for heating the gas before reaching the point of ignition. Figures 7 and 7^a represent a form of burner constructed with this view: The gas is made to traverse in the burner through nearly one half of the whole circuit of its circumference before it is allowed to escape through the holes from which it is consumed, by which means the gas is partially heated before reaching the point of ignition; *a a* are the perforations for the escape of the gas; b^1 b^2 the channels through which it flows to them; and c^1 c^2 are two auxiliary passages in which the gas is heated before entering into the channels b^1 b^2. Fig. 8 represents another mode of effecting the heating of the gas previous to combustion: *a* is the pipe through which the gas is admitted, and by which it is carried up nearer to the button or deflecting disc; it then descends inside another pipe *c*, surrounding the pipe *a*, and absorbs in its passage a considerable portion of heat from the heated surfaces of *a* and *c*; *d* is a third pipe which conveys the gas to the burner.

Fig. 8.



Digitized by Google

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

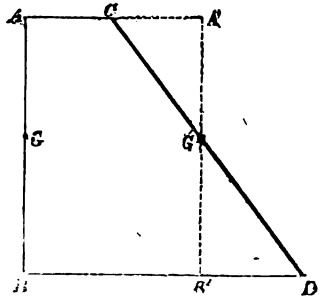
(Continued from p. 621, vol. xlvi.)

In the locomotive the only external force (besides the resistance of the air) is the friction which enables the wheel to lay hold of the rail, and by an action precisely the same as that of a cog-wheel and rack (only that the teeth of the wheel and rail are invisible from their minuteness), sends the engine on, because the rail is fixed (if the engine were fixed and the rail movable, it would be the rail that would be sent backwards, just in the same way as the engine is now sent forwards). The centre of gravity of the engine will therefore move in the same way as if this force were immediately applied to it. The motion of the various parts of the engine *amongst each other* can in no way affect the motion of the centre of gravity; they are of course necessary in order to produce the revolution of the wheels, and by their friction against the rails to obtain the *external* force; but of themselves they are entirely without influence on the progressive motion of the engine.

The fact that it is utterly impossible for any motion amongst the various parts of any machine to produce a motion of the centre of gravity—except in so far as this internal movement calls into play some force *external* to the machine—has been forgotten by many projectors, although all have not exhibited it in quite so barefaced a light as the worthy who proposed to propel a boat by simply erecting a large bellows near the stern, and blazing away at a board placed there. If he had been content with puffing away at "empty air," he would have got on better; for he would then have called into play an external force, namely the resistance, such as it is, of the particles of air to the impinging current from his bellows—and the re-action would have all been available, just as in the rocket.

This principle of the independence of the motions of rotation and translation being, as I have said, one of the most important and useful in mechanics, it is worth while to consider all the circumstances connected with it:

And, in the first place, since the effect of any force P on the motion of rotation depends on the distance of its point of application from the centre of gravity, whilst its effect on the motion of the centre of gravity is the same at whatever point of the body P be applied, it would appear at first sight that there is a *gain* of *force*, or a general increase of effect produced according as the point of P's application is further removed from the centre of gravity. But the consideration of one simple case will suffice to show the erroneousness of this. Suppose AB to be a rod, which by the action of some force applied to it at a point between G and B, transfers it into the position C D; the angle D G B, or A′ G C, will be greater the further from G the force has been applied. Now, if

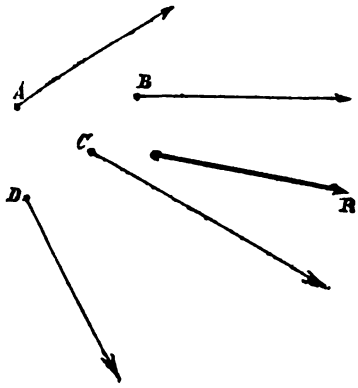


the same force had been applied directly at G, the middle, or centre of gravity, of the rod, and had acted for the same time, it would have carried it parallel to itself into the position A′B′. If, therefore, we take as the measure of the force the quantity of matter moved, multiplied by the velocity with which it is moved (or, which is the same thing, by the space over which it is moved in a given time), we see that the effects of the force, measured in this way, are the same, whether it has been applied at G or at any other point, inasmuch as they are represented by the equal areas A C B D, A A′ B B′.

The following is another method of considering the principle:

Suppose any number of bodies, or points, A, B, C, D, &c., perfectly unconnected with each other and free to move any how, are moving along certain fixed directions, as in the figure, with any velocities; since each body moves in a constant direction during the time we are considering, the direction of the force

Digitized by Google



acting upon it remains the same during this time, and may also be considered *uniform* during this time (for as the time during which the forces act does not at all affect our present question, we may take it as small as we please, and apply the reasoning of the differential calculus). Therefore the general resultant of all the forces will maintain a constant direction and magnitude during the time, as also will the resultant moment or "couple" (these two quantities being determined as if A B C D, &c., constituted a solid system). Now suppose all these separate bodies A, B, C, D, &c., to become suddenly connected together, so as now to form one rigid system. The motion of each individual body or particle will now be altered, in consequence of its connection with the rest; and in order to determine the subsequent motion of each we must take into account all the fresh forces thus introduced. For instance, if A become connected with B by a rigid rod, at the instant of connection, there arises a tension, or pressure, in this rod. Call it T; then, in addition to the force (P) which before acted on A, we must consider T; and so on for every other point. But T acts on B as well as on A, only in the opposite direction. Hence, in forming the general resultant of all these *new* forces, for every term (+T) there will be another (−T), so that the resultant of all this newly introduced force, as well as their resultant couple, or moment, is reduced to zero. Therefore the resultant of *all* the forces, originally acting and newly introduced, remains the same as before. If the direction of the resultant were that represented in direction and magnitude by the line R in the figure, *before* the connection, it will also be their resultant *after* that connection. Provided, therefore, the *external* forces acting on any system of particles or bodies, remain the same, the motion of the centre of gravity, and the rotation round that centre, will remain unaltered, whatever be the action of any one part of the system on another by means of any *mutual* forces, such as that of rods, &c. The preceding is similar to Poinsot's mode of considering the question in his *Memoire sur la Composition des Mouvements, &c.*; but he supposes the *velocities* of each of the points A, B, C, &c., before connection, to be *uniform*, and says, that therefore the "force which animates it remains constant:" it is better, however, I think, to consider the forces *acting* on A, &c., rather than the momenta *animating* them —and if the velocity be uniform, the force *acting* is zero. The theorems called "The Conservation of the Motion of the Centre of Gravity," and "The Conservation of Areas," are merely the expression of the results just obtained in an analytical form adapted to calculation—or, rather, I should say, the latter of these theorems is such.

There is another theorem of great practical use, which has received the name of the "*Principle* of Vis Viva," which differs however from the preceding principle, inasmuch as it is merely *a very useful equation or relation* amongst the various effects of the forces; whereas the other is a general principle, strictly so called: both, however, are of the greatest use in simplifying problems.

As this principle or equation of Vis Viva is of great importance in a practical point of view in the calculation of the "work done" by machines, I shall take up the subject from the beginning, assuming only the equations of motion. In most works, the investigation is founded on the principle of virtual velocities, which I consider to be very objectionable, as no proof of that principle has ever yet been given in which everybody agrees; and, at any rate, not one student in a thousand ever reads such proofs as have been given. As, moreover, there is not the slightest necessity or reason for any reference whatever to that principle, I think it far better to treat the subject independently. Suppose, then, m, m', m'',

Digitized by Google

&c., to be a system of particles anyhow connected, and acted on by external as well as by mutual forces. Let *all* the forces acting on (m) be equivalent to X, Y, Z acting along the co-ordinate axes. These forces, it must be recollected, are supposed to include the tensions, mutual pressures, and, in short, all the mutual actions of the other particles, as well as the given external ones:

$$\therefore \frac{d^2x}{dt^2} = X \quad \frac{d^2y}{dt^2} = Y \quad \frac{d^2z}{dt^2} = Z.$$

$$\therefore 2\frac{dx}{dt}.\frac{d^2x}{dt^2} + 2\frac{dy}{dt}.\frac{d^2y}{dt^2} + 2\frac{dz}{dt}.\frac{d^2z}{dt^2}$$

$$= 2.X.\frac{dx}{dt} + 2.Y.\frac{dy}{dt} + 2Z.\frac{dz}{dt}$$

$$\therefore \left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2 + \left(\frac{dz}{dt}\right)^2 \text{ or } V^2 = 2\int\left(X.\frac{dx}{dt} + Y.\frac{dy}{dt} + Z.\frac{dz}{dt}\right)dt$$

$$= 2\int\left(X\,dx + Y\,dy + Z\,dz\right)$$

$$\text{or } mv^2 = 2m.\int\left(X\,dx + Y\,dy + Z\,dz\right).$$

Similarly, if X′, Y′, Z′, represent the *whole* of the accelerating forces acting on (m'), then for its velocity (v') we should have

$$m'v'^2 = 2m'\int\left(X'\,dx' + Y'\,dy' + Z'\,dz'\right),$$

and so on for all the particles. But it is obvious, that in these equations, as they stand, we have, or may have, a number of *unknown* forces, inasmuch as X, Y, Z and X′, Y′, Z′ include the internal actions, of which we know nothing except that they are *mutual*. Fortunately this knowledge that they *are* "mutual" is enough to enable us to get rid of them: otherwise these equations first found would be of no earthly use. Suppose, therefore, that in addition to the external forces— all of which are known—there is included the tension or mutual pressure of a rigid rod connecting (m) and (m'). Denote this pressure by P. Let this rod or line mm' make angles α, β, γ with the axes. Then, amongst the accelerating forces acting on (m), we have

$\frac{P}{m}\cos\alpha$ acting along axis of x and $\therefore$ included in the X,

$\frac{P}{m}\cos\beta$ ditto y and $\therefore$ . . . . . Y,

$\frac{P}{m}\cos\gamma$ ditto z and $\therefore$ . . . . . Z.

But the *pressure* on the other particle (m') exerted along mm' is equal to that on (m other)cts in exactly the opposite direction. So that if one be considered positive, the will be negative. Hence, amongst the forces X′, Y′, Z′ acting on (m), there will be

$-\frac{P}{m'}\cos\alpha$ acting along axis of x, and $\therefore$ included in the X′,

$-\frac{P}{m'}\cos\beta$ . . . y, and $\therefore$ . . . . Y′,

$-\frac{P}{m'}\cos\gamma$ . . . z, and $\therefore$ . . . . Z′.

Therefore in forming the sum of mv^2 and $m'v'^2$ on one side of the equation, the other namely,

$$2m\int\left(X\,dx + Y\,dy + Z\,dz\right) + 2m'\int\left(X'\,dx' + Y'\,dy' + Z'\,dz'\right),$$

Digitized by Google

we shall have, amongst the rest, the following terms:

$$2 \cdot m \int \left(X \frac{P}{m} \cdot \cos \alpha \cdot dx + \frac{P}{m} \cos \beta \cdot dy + \frac{P}{m} \cos \gamma \cdot dz \right)$$
$$+ 2 m' \int \left(-\frac{P}{m'} \cos \alpha \cdot dx' + \frac{P}{m'} \cos \beta \cdot dy' + \frac{P}{m'} \cos \gamma \cdot dz' \right).$$
$$= 2.P. \int \cdot \cos \alpha \cdot \left(dx - dx' \right) + \cos \beta \left(dy - dy' \right) + \cos \gamma \left(dz - dz' \right) \Big\} \quad . \quad . \quad (A).$$

Now, the distance between (m) and (m') remains constant, since they are rigidly connected. Call this distance r, then

$$r^2 = (x - x')^2 + (y - y')^2 + (z - z')^2.$$
$$\therefore r dr = (x - x')(dx - dx') + (y - y')(dy - dy') + (z - z')(dz - dz')$$
$$= r \cdot \cos \alpha \cdot (dx - dx') + r \cdot \cos \beta \cdot (dy - dy') + r \cdot \cos \gamma \cdot (dz - dz')$$

the first side = zero since $dr = 0$, $\therefore$ the second also = 0,

$$\text{or } \cos \alpha (dx - dx') + \cos \beta (dy - dy') + \cos \gamma (dz - dz') = 0.$$

Therefore, the sum or expression (A) vanishes. Hence the mutual pressure P entirely disappears from the final sum. The same evidently is true for all such actions between every two particles.

Therefore in the equation,

$$mv^2 + m'v'^2 + m''v''^2 + \&c. = 2m \int (X dx + Y dy + Z dz')$$
$$+ 2m' \int (X' dx' + Y' dy' + Z' dz')$$
$$+ 2m'' \int (X'' dx'' + Y'' dy'' + Z'' dz'')$$
$$+ \&c. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (B).$$

the second side of the equation contains *no unknown tensions* or *mutual pressures*. If instead of a rigid rod, (m) and (m') be connected by a *string*, the preceding reasoning will be precisely the same *if the string remain tight and of the same length*, because then the distance (r) is constant, and $dr = 0$. If, however, the string be extensible dr may not $= 0$, and then we should have an unknown term $P dr$. If the particles be actually *in contact*, of course the preceding reasoning applies to their normal pressure, which is got rid of in the same way, and will not appear in the equation (B). Again, let (m) and (m') mutually attract each other, the law of attraction being any function of the distance (r), may be denoted by $f(r)$. The mutual force will be, therefore, $mm' f(r)$, the direction being opposite for m and m'. Hence in forming the sum on the second side of equation (B) we should have

$$\cdot mm' \int \left\{ \cos \alpha (dx - dx') + \cos \beta \cdot (dy - dy') + \cos \gamma (dz - dz) \right\} f(r).$$
$$= mm' \int f(r) dr.$$

[*Example.* Three particles $m\ m'\ m''$, at mutual distances $r_1\ r_2\ r_3$ attracting each other according to inverse square of distance.

$$mv^2 + m'v'^2 + m''v''^2 = -\mu \left(mm' \cdot \frac{1}{r_1} + mm'' \cdot \frac{1}{r_2} + m'm'' \cdot \frac{1}{r_3} \right) + C.]$$

Again, let there be impact between (m) and (m') during the motion, and suppose both perfectly elastic. Also let P = mutual pressure during contact at any instant. The direction of this normal force is supposed to remain the same during the contact. Then the action may be divided into two portions of equal duration, one (1) of compression, during which (r) the distance between them is continually diminishing and another (2) of expansion during which this distance is continually increasing, till it reaches its original amount. The term therefore $\int P dr$, which we have to take into account, is the same during these two periods but of contrary signs; therefore the sum = zero, and the term may be neglected. It will also be seen how the

Digitized by Google

collision of imperfectly elastic bodies may be taken into account; but I shall now go on to the explanation of how this general equation is applied in calculating the *work done* by any machine. The equation is generally written thus:

$$2m\int(X\,dx + Y\,dy + Z\,dz) + 2m'\int(X'\,dx' + Y'\,dy' + Z'\,dz') + \&c.$$

X, Y, Z being the *accelerating* forces which act on the particle whose mass is (m), and whose co-ordinates are x, y, z.

Now it will depend entirely on the student's knowledge of the *principles* of the integral calculus, whether he will be able to attach any definite *physical* meaning to the second side of this equation, or whether he will see nothing but a mere piece of algebraic work to be performed. In the first place, then, it must be remembered — and, indeed, ought never to be forgotten in any physical problem—that an "*integral*" is a "*sum*," and moreover (which is very seldom attended to) that in the expression $\int P\,dx$ the factor (dx) is not by any means to be omitted in *forming that sum*. As, however, we are not explaining the differential and integral calculus, a thorough acquaintance with its application to physics is taken for granted; the *use* to which the preceding integrals will be put affording us a good illustration of all such applications. The *work done* by a machine is conveniently *measured* by the number of pounds raised one foot high—or generally by P × S, P denoting the pressure overcome through a space S by the machine. Hence we see how conveniently the preceding formula is adapted to the purpose of calculating such work, involving as it does on one side the sum of such terms as $P\,dx$, P denoting a pressure, and (dx) the space through which it is moved. This use will best be seen by taking an actual case, and going through it. This we shall do in the next paper.

$$\Sigma.mv^2 = 2\,\Sigma.m\int(X\,dx + Y\,dy + Z\,dz)$$

the symbol (Σ) denoting the *sum* of all such terms as that to which it is prefixed: for instance, the second side is equivalent to

P. S.—There are several misprints in my last, as well as in former articles. At present, I shall merely notice the following in my last: Page 620, col. 2, line 17, for "run" read "*mn*;" and next col. line 19, for "goes" and "describes," read "go" and "describe," omitting the stop. Also page 620, line 38 of col. 1, the word "None" ought not to begin a fresh sentence.

(*To be continued.*)

GEOMETRY OF THE LINE AND PLANE.—BY T. S. DAVIES, F.R.S., L. & E., F.S.A., ROYAL MILITARY ACADEMY, WOOLWICH.

(Continued from p. 542, vol. xlvi.)

Postulates.

1. A plane may be drawn through any given straight line, or through any two points, however the line or the points may be situated in space.
2. A plane may be revolved about a straight line in it, till it shall pass through any given point.
3. A plane may be revolved about a line in it, till it coincides with any other plane drawn through that line.
4. A line may be drawn through any two given points in a space.
5. A line may revolve about a given point so as to pass through all the points of a given curve anyhow situated, in succession.
6. About any given point as a centre, and with any radius, a sphere may be described.
7. In any plane either given or constructed, all the operations of plane geometry may be performed.*

---

* For examples, see note C. The student is desired to refer to this note: which, with A and B, will be given in the next number.

Digitized by Google

8. A line may be superposed on another line, or a plane on another plane, under the same conditions and in the same manner, as in plane geometry.

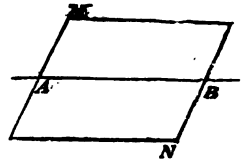
9. A line, a plane, a cone, and a cylinder, may be extended as far as our reasonings may require.

Axioms and Simple Properties.

Although an axiom is, in strictness, an ultimate truth which does not admit of proof in a logical form from any antecedent property or other axiom, yet there are some properties usually classed as propositions, *which* are so elementary, as to render it sometimes doubtful whether the argument employed in their demonstration, when denuded of its mere form, is anything more than a verbal explanation of an ultimate truth. To avoid all discussion of this kind, however, the properties here given are followed by such remarks, or reasonings, as shall place them within the range of admissible truths whatever may be the theory of geometrical philosophy adopted by the reader.

1. If two points be situated in a plane, the straight line drawn through them and indefinitely produced, shall be wholly in that plane.

Thus, let MN be a plane, and A, B, two points in it: then the line AB being drawn and indefinitely produced, as to D, this line shall lie wholly in the plane MN.

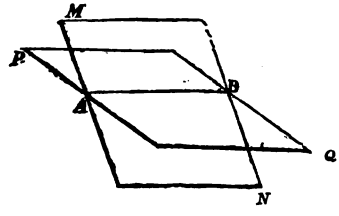


For, (*Euc. i. di. f.* 7.) the part AB lies in the plane MN; and (*Euc. eax.* 2.) this may be produced indefinitely from A or B. Whence the straight line extended through A and B lies wholly in the plane MN; since there is no limit to the extension of this line prescribed, in either direction, by the definitions of the line and plane.

2. If two planes intersect, their intersection will be a straight line.

Thus, let MN, PQ in two planes which intersect, their line of section AB will be a straight line.

For let A, B, be two points in their line of section; then the straight line which joins them lies in *each* of the planes MN, PQ; and hence in both of them; and, therefore, it is their intersection.



3. The position of a plane is not fixed by only *two* points in it, nor by any number of points all ranged in a straight line.

Thus, in the preceding figure two planes pass through the points A, B; and in a similar way it is obvious that any number may.

4. If a plane pass through two points in a line, it passes through every point in that line.

For the line lies wholly in that plane (*ax.** 1.)

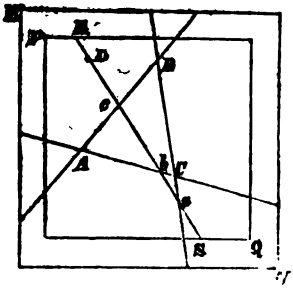
5. If two planes coincide in three points which are not in the same straight line, they will wholly coincide however far they may be extended.

---

* The propositions of this series, whatever be their real character, will be quoted as *axioms*, for the sake both of brevity, and of distinguishing them from the propositions, which are, in the subsequent part, regularly numbered from the commencement.

Digitized by Google

Thus, let the two planes MN, PQ coincide in the points A, B, C, and let D be any other point in PQ, it will also be in MN.



Draw and produce the lines AB, BC, CA; these will be in both planes, (*ax.* 1.)

Through D draw in the plane PQ, and any line to cut two sides of the triangle ABC in two points, as *a* and *b*. The points *a*, *b* bring in both planes, the line *ab* is in both planes; and the plane MN passing through the two points *a*, *b*, it passes through every point, including D, in that line. The point D is therefore also in the plane MN. In the same way it appears that every point in one plane PQ, is in the other plane MN; or, in other words, that the planes wholly coincide.

6. The three sides of a triangle are in one plane.

For they are each in the plane drawn through the three angular points.

7. Two straight lines which meet, or which being sufficiently produced would meet, are in one plane.

For a plane drawn through one of the lines, and a point in the other, besides that in which they intersect (which is necessary in both lines), gives that point and the point of intersection in the plane so drawn. The second line is therefore also in the plane (*ax.* 4.); and hence they are both in one plane.

8. If from two points in two parallel lines, one in one and the other in the other, a line be drawn, it will lie wholly in the plane which contains the parallels.

This is only a varied expression of *ax.* 1, in a form to meet a case of frequent occurrence. Euclid makes it a distinct proposition, viz., *ei.* 7.

9. A line and plane can only intersect in one point.

For if the line could meet the plane in a second point, it would lie wholly in that plane, by *ax.* 4.

10. Two planes can only intersect in one straight line.

For if they could meet in any point without that line, they would coincide in three points (any two in the line, and the one assumed without), which are not in a straight line, and hence they would wholly coincide (*ax.* 5).

11. Through the same point in space only one line can be drawn parallel to a given line.

For the parallels are in one plane, viz., that which passes through the line and point; and it is a familiar property in plane geometry that only one line can be so drawn in that plane.

12. If a plane cut one of two parallel lines, or one of two parallel planes, it will cut the other.

13. If a line cut one of two parallel planes, it will cut the other.

14. A line cannot be parallel to two straight lines except those lines be parallel to one another.

15. Through the point in which two lines intersect, one line can be situated at right angles to both of them.

These four evident facts have been usually assumed by geometrical writers without a formal enunciation.

16. If a line meet a plane, every plane drawn through that line will cut the former plane.

For, since the line cuts the first plane in a point, the plane through it also passes through that point since the line lies wholly in this second plane.

17. If two planes be given, if a line and plane be given, or if any two figures which intersect be given, their intersection is to be considered as given.

For, since the mode in which figures in this department of geometry are given, is their actual exhibition to the mind in magnitude, species, and position, all intersections are included in the figures so exhibited.

(*To be continued.*)

Digitized by Google

NEW, FLAT, ONE-FLUKED ANCHOR.

Fig. 1.

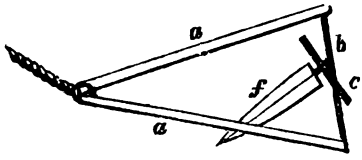


Fig. 2.

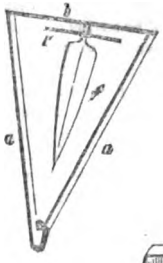


Fig. 3.

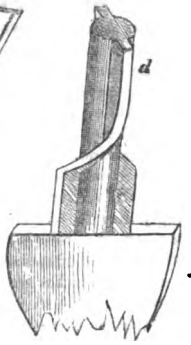
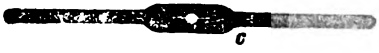


Fig. 4.



Sir,—I send you a design for an anchor intended for small boats, and, in my opinion, in many respects superior to those now in use.

Figure 1 shows the anchor when "in holding," and fig. 2 represents it when stowed away; the letters refer to the same parts in all the figures.

a is a frame consisting of two sides of an isosceles triangle, with a ring at the vertex, to which is to be attached the cable. The bar *b* turns in two holes at the ends of *a a*, and is firmly fixed to the flat fluke *f*. On being lowered into the water, it is plain that the anchor will rest only in two positions, and the weight of the fluke will cause it to catch the ground. No further construction would be necessary for the perfect action of this anchor when used on soft ground, or level hard bottom; but for further and complete security, there is attached the bar *c*, which, being at right angles to the plane of *a a*, will be dragged along the ground so as to turn the fluke downwards. This bar need not project more than a couple of inches; but if it be desired to render the whole apparatus perfectly flat when not in use, the simple modification, shown in figs. 3 and 4 may be given to it. Fig. 4 shows the bar *c*, in the centre of which is a circular aperture with two longitudinal ones, forming part of an inside screw. The part of the fluke, which is between its blade and the bar *b*, is cylindrical, and has two threads of a screw running half a revolution round it. Now, when the anchor is to be stowed away, the bar *c* will be parallel with *b*, but when required for use it must be slipped up the screw, and thus made to assume a position at right angles to its former one.

Of course, the bar *b* must have its ends so forged as to be capable of turning only to about half a right angle on either side of the plane of *a a*.

In the common form of anchor the stock is very liable to foul the cable, and, as well as both flukes, frequently injures the bows of the vessel when being weighed. If the anchor has a movable stock, it is impossible to cross it readily when there is a sudden necessity for speedily casting anchor. Besides this, the projecting upper fluke of the common anchor often fouls the rope attached to it, and not unfrequently in shallow water damages the bottoms of craft floating above it.

All these objections are met in the new construction and obviated, while it renders an anchor most convenient for stowage in small boats in that triangular space which is always floored at the bows.

I am, Sir, &c.,

JOHN MACGREGOR.

Battersea.

MR. JACOB BRETT'S ELECTRIC PRINTING TELEGRAPH.

Sir,—I am glad that Mr. Brett has been induced to notice personally my remarks on Mr. French's statements. It was not from ignorance of the fact that Mr. House is co-patentee with Mr. Brett, that I mentioned only the name of the latter gentleman in connection with the American telegraph. I really thought that in so doing

Digitized by Google

my meaning would be sufficiently intelligible.

Mr. Brett may of course, even at this late period of the "controversy," disclaim the statements which have been made for him. He cannot, however, with the same impunity, recede from, or evade, those which he has not merely allowed, but has personally promulgated. The three paragraphs which immediately precede the conclusion of my last letter, in No. 1245 of your Magazine, refer to such statements. I am far from wishing to intrude unseasonably upon Mr. Brett's time, and I therefore willingly accede to his desire, that all questions as to the relative value of the inventions should be suspended. I cannot, however, consent to forego that claim, which I (in common with all your readers) have, to an explanation of assertions which appear so extraordinary, repeated as they have been on so many occasions, but without any proof forthcoming. This is not a question of "merits," but of *facts*.

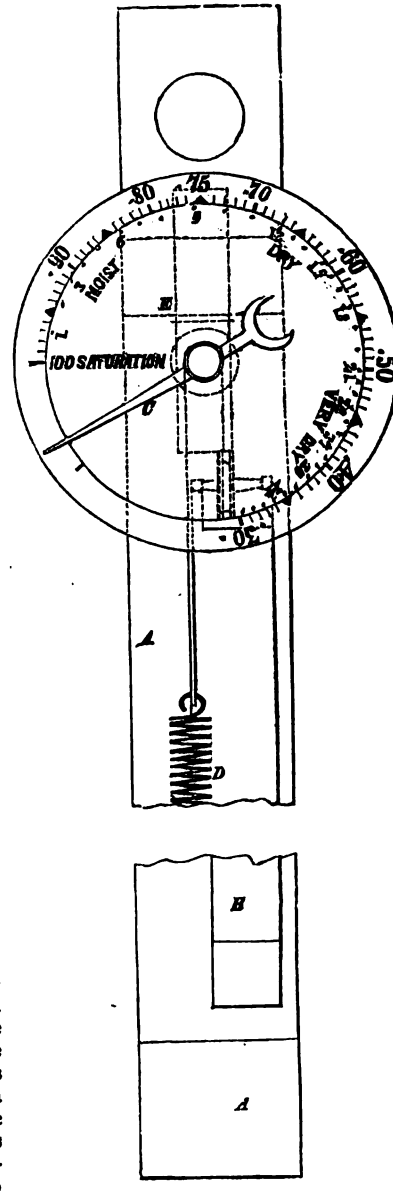
I am, Sir, yours, &c.,
TYRO ELECTRICUS.

London, June 28, 1847.

SIMMONS'S PORTABLE HYGROMETER.

[Registered under the Act for the Protection of Articles of Utility. E. L. Simmons, of Coleman-street, Proprietor.]

The use of the hygrometer for horticultural purposes (in which its chief value lies) must be greatly promoted by this very improved edition of the instrument. It not only shows at sight the humidity of the atmosphere in decimal parts of the saturation, but furnishes an instantaneous means of ascertaining the dew pent. A is a back-piece, of metal or glass; B, a long thin piece of wood, with the grain running in a transverse direction to its length, which is made fast at the lower end to the back-piece A, and connected at its upper or free end to the axis of the index hand C of the dial-plate E, on the face of which the decimal parts are engraved; and D is a spiral spring which is secured to a bracket projecting from the back-piece A, and connected by a cord to the axis of the index hand C. The constant tendency of the spiral spring and cord is to keep the index hand at what may be called its normal state; while the piece of wood, being elastic, expands and contracts with the increase or diminution of moisture in the atmosphere; and, as it contracts or expands, draws the index-hand round in one direction or the other.



The dew point is ascertained by subtracting the number under the index-hand from the temperature of the air at the time; the remainder being the dew point, or the temperature in degrees of Fahrenheit corresponding to the quantity of moisture in the atmosphere.

Digitized by Google

I. SELECTION OF APPROPRIATE RESULTS. EXERCISE.

The selection—from amongst the many results which are often given by our final expression—of the appropriate solution of the given problem, is a subject to which I have made allusion in my Fifth and Sixth *Notes on the Theory of Algebraic Equations* (*a*). As, however, the discovery of rules (should any such exist), which shall enable us to distinguish *à priori* the valid from the invalid results, is a question the importance of which is not confined to any one branch of pure or applied Analytical Science, I have thought it better to separate its discussion from that of the Theory of Equations with which, as I have just observed, it has no exclusive connection. Although commencing with the consideration of this point, I do not intend the present series of papers to be restricted to it. In fact, the Exercise with which the present article concludes is unconnected with the rest of the paper.

In the two "*Notes*" above alluded to will be found instances in which we have been conducted to appropriate results by attending to the symbolical meaning of our formulæ. But we shall also find a case which shows that, as an *exclusive* test, no scrutiny of the symbols will, alone, enable us to arrive at general conclusions. We must, as before remarked (*b*), have recourse to more extended considerations if we wish to obtain criteria universally applicable—supposing, of course, that such criteria exist.

The result obtained at page 491 of vol. xlvi. of this work is undoubtedly the true one, and would seem to be arrived at in a proper manner. Let us bestow a little further consideration upon it.

The solution "40", then, of the question there adverted to, is an *ambiguous* one. It might be urged that the equation

$$x(30-x)=8(30-2x),$$

by means of which the problem may be expressed (*c*), shows that

$$30-2x \text{ or } -50$$

is the "difference" of the "parts" if we use the word "difference" in the sense which it bears in the operations which conduct to the solution of the problem. And we have already seen (*d*) that such an interpretation of the word "difference" enables us to satisfy the algebraical conditions. Nevertheless we have violated the fundamental assumption of the problem, viz. that

"x=the *lesser* part," (*e*)

of the two into which the number 30 is to be divided. But "-10" is the "part" which satisfies the above assumption. Hence we may pronounce the result "40" to be an *ambiguous* one.

Next, in solving the problem of page 491 of vol. xlvi., let us assume that

x=the *greater* part,

then we shall have

$$x(30-x)=8(2x-30),$$

or $$x^2-14x=240,$$

and $x=7+\sqrt{(\pm 1)^2 17^2}=24$ or -10.

These results are *complementary* to those obtained on the former assumption. The solution "24," which results from considering the "240" as affected with $(+1)^2$ is the true one. The result "-10" is ambiguous. It will be remarked that the available result in the note (*k*) *supra*, p. 492, is obtained by affecting the "6" with $(+1)^2$.

Again, following a different process, let us assume that x and y are the parts into which 30 is to be divided so as to satisfy the conditions of the preceding problem; then

$$x+y=30 \ldots\ldots (1)$$

$$x-y=\tfrac{1}{8}xy \ldots\ldots (2),$$

and if we substract the square of equation (2) from that of equation (1) we shall have

$$4xy=30^2-(\tfrac{1}{8}xy)^2$$

or $$(\tfrac{1}{8}xy)^2+32(\tfrac{1}{8}xy)=30^2$$

$$\tfrac{1}{8}xy=-16+\sqrt{(\pm 1)^2 30^2+(\pm 1)^2 16^2}$$

$$=-16\pm 34=18 \text{ or } -50,$$

and considering the 30^2 as affected with $(+1)^2$ we obtain

$$x+y=30$$

(*a*) *Ante*, pages 490 and 516.

(*b*) *Ante*, page 517.

(*c*) Bridge, *Algebra*, Sixth Edition, page 97.

(*d*) *Ante*, page 491, 2d, column.

(*e*) Bridge, place quoted in (*c*).

Digitized by Google

$$x-y=18$$

$$\therefore x=24, \text{ and } y=6$$

the required parts. Had we taken -50 as the value of $\frac{1}{2}(xy)$ we should have had $x=-10$ and $y=40$, while (2) shows, or rather tacitly assumes, that x is the greater of the two parts. In this solution we are consequently involved in the same inconsistencies as in the preceding ones. But we shall probably find that one will throw light on another.

In fact, in this last solution we see that the ineffective solution is introduced by our giving the double sign $(\pm 1)^2$ to the 30^2. The condition (1) is, since 30 is positive,

$$x+y=(+1)\times 30$$

hence $(x+y)^2=(+1)^2\times 30^2$,

and since the 30^2 is introduced into our processes by means of the last equation, we see why the square root in the above investigation is to be taken positively. Although this observation will in the present paper close my remarks upon the above problem, it is not unlikely that at some future time it will become desirable to consider the relation of the last to the two preceding solutions.

Even when employed as a test of the *admissibility* of results, we must be sure that the rigid interpretation of the meaning of our symbols is not inconsistent with other conditions imposed by the nature of the problem. It will be necessary, therefore, before attempting to employ any test, to see that the formula or expression, to which we may wish to apply it, is unfettered by any extrinsic limitations. The following example will show that we should in certain cases be led into error by losing sight of such extrinsic restrictions:

"Ex. 2. What two numbers are those whose sum multiplied by the greater is 209, and whose difference multiplied by the less is 24?" (*f*)

The equations of the problem are

$$x^2+xy=209\ldots.(3)$$

$$xy-y^2=24\ldots.(4),$$

the solution of which is made to depend upon that of a quadratic in an auxiliary quantity z (*g*), which has two roots $\frac{8}{11}$ and $\frac{8}{19}$ (*h*). Now on the principles of selection heretofore employed, the *latter* would seem to be the appropriate solution, while, in fact, the *former* is the one which must be adopted. Why, then, in the present instance are we not only not served, but actually *misled* by our system of interpretation taken in its unrestricted form?

It is because we have not taken *all* the requisites of the problem into consideration; it is because the relation of the above two equations to one another must be taken into account. Thus, suppose that we have arrived, no matter how, at 11 as an appropriate value of x. Solving (4) with respect to y we obtain

$$y=\frac{x}{2}+\frac{1}{2}\sqrt{(-x)^2-96}$$

$$=\frac{x}{2}-\frac{1}{2}\sqrt{x^2-96}$$

according to our mode of selection; this gives $y=3$, a value which does not satisfy (3). But if we consider the radical as *positive*, (x, as before observed, being equal to 11,) we have $y=8$, a value which satisfies (3). Our interpretation is, then, only invalidated by considerations purely collateral, not by any intrinsic defect; it requires, to perfect it, extension, not correction, of our views.

Such extension we must endeavour to give them; and we must remember that similar considerations may be employed in every department of science in which a result may have more than one origin. In such case the ambiguity may, at least in some instances, be removed by a reference to the conditions of the problem, and by a reasoning similar to that which we have employed in the present case. We shall of course have other symbols to deal with than those above considered. In some branches of analysis we may, as in the present, have solutions too restricted as well as others too large. But into this I shall not here attempt to enter.

Perhaps there are some of your readers who may think it worth while to work the following little Exercise. It is here given to illustrate a certain *class* of propositions, and not from any peculiar merits which it possesses in itself:

A farmer on buying a certain number of beasts gave for each beast a number of pounds LESS *by unity than the* number of beasts; *but he paid the same price for each beast: and the expenses of getting them home amounted to one pound: A second farmer on buying the same number of beasts gave for each beast* as many pounds MORE *than*

(*f*) Kelland, *Algebra*, (1839), page 150.
(*g*) Ibid. (*h*) Ibid. page 151.

Digitized by Google

the number of beasts *he bought as the first farmer had given* less: *the expenses of getting these beasts home cost the second farmer one pound: A third farmer bought a number of beasts and gave for each beast* one *pound more than the number of beasts he purchased; it also cost the third farmer one pound to get the beasts home: On multiplying the total number of pounds paid by the first farmer, by the total number of pounds paid by the second, it was found that the product equalled the total number of pounds paid by the third farmer. Show that the number of beasts bought by the third farmer was the* square *of the number purchased by each of the others.*

(*To be continued.*)

THE CALCULATION OF EARTHWORKS.*

The tendency of even *transcendental mathematics* in the present day, is towards a practical application; and in many of the highest minds may be traced a disposition to merge the highest achievements of symbolism in the search after mundane utility. This is one remarkable feature of the age in which we live; and we trust the day is not distant when the *mécanique terrestre* will receive as much honour for its cultivation, as in the past one has been awarded to the labourers for the perfection of the *mécanique céleste*. The former requires mathematical powers quite as exalted for its due culture as the latter—indeed, we think, even more exalted. Men *now* think more about the *utility* of an inquiry than about either its *difficulty* or its *popularity* in the learned coteries. This is one of the symptoms of a returning healthiness of mind, and of the disrepute into which learned unintelligibility is fast falling. We do not, indeed, belong to the school which would discourage the most profound symbolical research; but we would see every eminent symbolist keeping a due recollection of the ultimate objects which, as a man and a member of the social body, should constitute with him the ultimatum of all scientific studies. The phenomena of astronomy and physical optics are, however, as yet, almost the only subjects which our higher analysts have considered to be *worthy* of mathematical treatment; but in these the success has been commensurate with the transcendent powers employed upon the research. Yet are these the *only* objects worthy of the contemplation of man? Is it nothing that the labours of the geometer in his study shall give manifold increase to the powers of production, or materially lessen the cost of labour by which our daily wants are supplied?

We might quote many authorities in favour of the very different views to which we incline; but that of Mr. Bashforth will be sufficient for our present purpose. We here see a gentleman of high powers and great mathematical attainments, devoting his personal researches to the best mode of accomplishing the practical solution of a problem in mensuration. We see a fellow of the second college (or may be, in some respects, the first) in the University of Cambridge, instructing a surveyor's clerk how to perform his own work with greater facility and more effectively than he could before do it. This is doing homage to the great purposes of all science, and the seeming humility of such an undertaking, whatever the *soi-disant* "learned" may think, bespeaks a far better judgment than spending a life of listless ease within college-walls, and dreaming over barely possible improvements in the minute details of celestial physics.

But this is not all. It should convince our vain, off-handed men of routine—the "rule of thumb" professionals—that mathematical science *is* of real value in practical life. True it is, that experiments upon its value have only been made on a very limited scale; for the contemptible jealousy with which our practical engineers look upon all mathematical inquirers, has rendered it impossible for men of science to ascertain the purposes to which scientific men might best direct their efforts for aiding the practical. They determine, as if by common consent, that men shall serve two apprenticeships, to understand one trade—an apprenticeship to science, ending at three or four and twenty,

* A General Table for Facilitating the Calculation of Earthworks for Railways, Canals, &c. With a Table of Proportional Parts. By Francis Bashforth, M.A., Fellow of St. John's College, Cambridge. London: Bell, Fleet-street, 1847.

Digitized by Google

and a professional apprenticeship, that may terminate some time before a man is thirty years of age! Our engineers grasp at too much; and, in many cases, only the shadow of the substance is their reward. Witness the Dee Bridge (and "skew-bridges" in general, which are scarcely less unsafe) and "No. 40" of the Brighton locomotives: when any mathematician, who had studied these subjects, would have foretold the fatal results. Many more such are in store, at the cost of her Majesty's lieges, and in illustration of the ignorant and criminal vanity of our "practical engineers." A better order of men, too, than the "Royal Engineers" who are appointed inspectors of railways, must be brought into the engineering profession. And they must be men to whom we can safely entrust a *veto* on *all works* which involve the public interests and the public safety. True, such a veto exists now, but *who exercises it?* We need only recall to our readers' recollection, that the highest authority (Sir Charles Pasley) amongst the *Royal Engineers*, sanctioned the opening of the Chester Bridge. The poor old gentleman "looking very foolish" (as he is said to have done before the coroner's inquest) is little compensation to the bereaved families of the sufferers by that sad catastrophe; nor is it likely to add to the comfort of those who may be conscious that they are exposed to half-a-dozen similar dangers upon every line they travel over! We leave this painful subject, however, *for the present*, and return to that from which we had, almost unconsciously, been led astray. The considerations belonging to both, being nearly identical, must be our apology.

There is one principle assumed in all the Earthwork Tables that have yet been published: viz., that the surface of the cutting is a plane. This is, perhaps, a condition that is seldom fulfilled with any degree of rigour; but for short distances (as a chain in length) the difference is probably such as to deserve but little notice in large estimates, the opposite errors nearly balancing each other when extensive cuttings are to be made. Without a more rigid scrutiny into the details than we have time to make, we should, however, feel some hesitation in pronouncing positively upon this question. We trust that the long-continued state of precarious health of one of our correspondents who commenced a course of inquiry into this subject, will not compel him to leave his investigations unfinished. For the present, at any rate, *we* shall not discuss it; but take the usual view for granted, as a sufficiently near approximation.

In this case the excavation between the limits of the chain-length is the ordinary "truncated triangular pyramid" of our books on mensuration; having a segment cut off by a plane parallel to one of the edges of the prism. It is under this very convenient form for calculation that Mr. Bashforth views the solid of excavation. The investigations are given in a perfectly scientific manner, and perfectly free from all affectation of notation, which, from being unusual, would be unintelligible to the great mass of his readers. In fact, the only symbol that does not occur in our oldest books of mensuration, in this work, is Σ (∇), signifying the sum of all the volumes of the separate chain-cuttings.

The example of the use of the Table, at page 7, is clearly explained, and it illustrates the use of the Table completely for cases of ordinary occurrence.

Again, cuttings have usually been limited within sixty-five feet depth; probably from it being deemed that when the hill exceeds that height, it would be cheaper to tunnel than to excavate an open road. This may not always, however, be true, as the nature of the ground may be such as to render a deeper cutting more feasible than a tunnel. To meet these cases, Mr. Bashforth has extended the *use* of his table to any multiple of sixty-five feet, without increasing the *actual table* itself.

Further, the author has given an elegant and original formula for interpolating the volumes, where the cuttings are any decimal or centesimal parts of a foot more than any pair of integers in the table. This is of the utmost importance in estimates for

Digitized by Google

contracts and for work actually done. It seems to fulfil the precise purpose contemplated by Mr. Colvin in our last number. To effect this more readily, Mr. Bashforth has devised a very commodious slide-rule for finding by inspection the values of $2a + b$ and $2b + a$, which occur in his formula; and then the whole process is reduced to the use of his general table precisely as in the ordinary cases.

Some judicious remarks on "the interpolation of heights" closes this little volume; a volume which should become *the* handbook of every person whose professional duties require even occasional calculations of this nature. Were it only, that it is more extensively applicable than any other in existence, we could recommend it most cordially to our readers; but when they learn that the use of it *involves only half the labour* of all other tables constituted for the same purpose, we offer the strongest of all recommendations, that founded on *the value of time*.

We would fain hope that we shall ere long see Mr. Bashforth producing other proofs than this of the great value of mathematical science to the engineering profession; and we take our leave of his little work, with a sincere hope that his career will be as bright as his powers and acquirements deserve.

DISCOVERIES OF THE PAST YEAR.

[From the Address of the President of the Oxford Meeting of the British Association, Sir Robert Inglis, Bart.—As reported in the *Athenæum*.]

Tides in the Air as well as in the Sea.

The doctrine of the influence of the moon and of the sun on the tides was no sooner established than it became eminently probable that an influence exerted so strongly upon a fluid so heavy as water, could not but have the lighter and all but imponderable fluid of air under its grasp. I speak not of the influence attributed to the moon in the popular language and belief of nations ancient and modern,—of Western Europe and of Central Asia, in respect to disease; but of the direct and measurable influence of the moon and of the sun in respect to the air. It is now clear, as the result of the observations at St. Helena by my friend Col. Sabine, that, as on the waters, so on the atmosphere, there is a corresponding influence exerted by the same causes. There are tides in the air as in the sea; the extent is, of course, determinable only by the most careful observations with the most delicate instruments; since the minuteness of the effect, both in itself and in comparison with the disturbances which are occasioned in the equilibrium of the atmosphere from other causes, must always present great difficulty in the way of ascertaining the truth—and had, in fact, till Col. Sabine's researches, prevented any decisive testimony of the fact being obtained by direct observation. But the hourly observations of the barometer, made for some years past at the Meteorological and Magnetical Observatory at St. Helena, have now placed beyond a doubt the existence of a lunar atmospheric tide. It appears that, in each day, the barometer at St. Helena stands, on an average, four-thousandths of an inch higher at the two periods when the moon is on the meridian above or below the pole, than when she is six hours distant from the meridian on either side; the progression between this maximum and minimum being moreover continuous and uninterrupted, thus furnishing a new element in the attainment of physical truth; and, to quote the expression of a distinguished foreigner now present, which he uttered in my own house when the subject was mentioned, "We are thus making astronomical observations with the barometer"—that is, we are reasoning from the position of the mercury in a barometer, which we can touch, as to the position of the heavenly bodies, which, unseen by us, are influencing its visible fall and rise. "It is no exaggeration to say,"—and here I use the words of my friend, the Rev. Dr. Robinson,—"that we could even, if our satellite were incapable of reflecting light, have determined its existence—nay, more, have approximated to its eccentricity and period."

Animal Electricity.

In physiology, the most remarkable of the discoveries, or rather improvements of previous discoveries, which the past year has seen, is, perhaps, that connected with the labours of the distinguished Tuscan philosopher, Matteucci; who, on several former occasions, has co-operated with this association in the sections devoted to the advancement of the physical and physiological sciences. I refer in this instance to his experiments on the generation of electric currents by muscular contraction in the living body. This subject he has continued to pursue; and, by the happy combination of the rigorous methods of physical experiment with the ordinary course of physiological research, Professor Matteucci has fully established the important fact of the

Digitized by Google

existence of an electrical current—feeble, indeed, and such as could only be made manifest by his own delicate galvanoscope—between the deep and the superficial parts of a muscle. Such electric currents pervade every muscle in every species of animal which has been the subject of experiment; and may, therefore, be inferted to be a general phenomenon of living bodies. Even after life has been extinguished by violence, these currents continue for a short time; but they cease more speedily in the muscles of the warm-blooded than in those of the cold-blooded animals. The Association will find his own exposition of the physiological action of the electric current in his work, *Leçons sur les Phénomènes Physiques des Corps Vivants*, 1847.

The delicate experiments of Matteucci on the Torpedo agree with those made by our own Faraday upon the *Gymnotus electricus*, in proving that the shocks communicated by those fishes are due to electric currents generated by peculiar electric organs, which owe their most immediate and powerful stimulus to the action of the nerves.—In both species of fishes the electricity generated by the action of their peculiar organized batteries—besides its benumbing and stunning effects on living animals—renders the needle magnetic, decomposes chemical compounds, emits the spark, and, in short, exercises all the other known powers of the ordinary electricity developed in inorganic matter or by the artificial apparatus of the laboratory.

Etherization.

The influence of the vapour of ether on the human frame is a discovery of the last year, and one the value of which in diminishing human pain has been experienced in countless instances, in every variety of disease, and especially during the performance of trying and often agonizing operations. Several experiments on the tracts and nerve roots appropriated respectively to the functions of sensation and volition have been resumed and repeated, in connection with this new agency on the nervous system. Messrs. Flourens and Longet have shown that the sensational functions are first affected, and are completely, though temporarily, suspended under the operation of the vapour of ether; then the mental or cerebral powers; and, finally, the motor and excito-motor forces are abrogated. It would seem that the stimulus of ether, applied so largely or continuously as to produce *that* effect, is full of danger—and that weak constitutions are sometimes unable to rally and recover from it; but that when the influence is allowed to extend no further than to the suspension of sensation, the recovery is as a general rule complete. It is this remarkable property of ether which has led to its recent application with such success as may well lead us to thank God, who, in His Providence, has directed the eminent physicians and surgeons amongst our brethren in the United States to make this discovery;—a discovery which will long place the name of Dr. Charles J. Jackson, its author, among the benefactors of our common nature.

At the same time, much careful observation, on the *modus operandi* of this most singular agent, seems still requisite before a general, systematic, safe, and successful application of it can be established for the relief of suffering humanity.

The Electric Telegraph.

The extension of the means of communication by the Electric Telegraph is yearly facilitating intercourse, almost as rapid as light or as thought, between distant portions of England, and between distant provinces in the vast empire of our Queen.

The last pamphlet which I had in my hand before leaving home yesterday, was a Report presented to the Legislative Council and Assembly of New Brunswick, relative to a project for constructing a railway, and with it a line of electro-magnetic telegraph, from Halifax to Quebec.

Distance is time; and when by steam, whether on water or on land, personal communication is facilitated, and when armies can be transported without fatigue in as many hours as days were formerly required, and when orders are conveyed from one extremity of an empire to another almost like a flash of lightning, the facility of governing a large state becomes almost equal to the facility of governing the smallest. I remember, many years ago, in the *Scotsman*, an ingenious and able article, showing how England could be governed as easily as Attica under Pericles: and I believe the same conclusion was deduced by William Cobbet, from the same illustration.

The system is daily extending. It was, however, in the United States of America, that it was first adopted on a great scale, by Professor Morse, in 1844; and it is there that it is now already developed most extensively. Lines for above 1,300 miles are in action, and connect those States with her Majesty's Canadian provinces; and it is in a course of development so rapid, that, in the words of the report of Mr. Wilkinson to my distinguished friend, His Excellency Sir W. E. Colebrooke, the Governor of New Brunswick, to which I have just adverted, "No schedule of telegraphic lines can now be relied upon for a month in succession, as hundreds of miles may be added in that

Digitized by Google

space of time. So easy of attainment does such a result appear to be, and so lively is the interest felt in its accomplishment, that it is scarcely doubtful that the whole of the populous parts of the United States will, within two or three years, be covered with a telegraphic network like a spider's web, suspending its principal threads upon important points along the sea-board of the Atlantic on one side, and upon similar points along the Lake frontier on the other." I am indebted to the same Report for another fact, which I think the Association will regard with equal interest: "The confidence in the efficiency of telegraphic communication has now become so established, that the most important commercial transactions daily transpire, by its means, between correspondents several hundred miles apart. Ocular evidence of this was afforded me by a communication, a few minutes old, between a merchant in Toronto and his correspondent in New York, distant about 632 miles." I am anxious to call your attention to the advantages which other classes also may experience from this mode of communication, as I find it in the same Report. When the *Hibernia* steamer arrived in Boston, in January 1847, with the news of the scarcity in Great Britain, Ireland, and other parts of Europe, and with heavy orders for agricultural produce, the farmers, in the interior of the States of New York,—informed of the state of things by the Magnetic Telegraph—were thronging the streets of Albany with innumerable team-loads of grain almost as quickly after the arrival of the steamer at Boston as the news of that arrival could ordinarily have reached them.—I may add, that, irrespectively of all its advantages to the general community, the system appears to give already a fair return of interest to the individuals or companies who have invested their capital in its application.

The larger number of members of this Association have probably already seen in London an exhibition of a Patent Telegraph which prints *alphabetical* letters as it works. Mr. Brett, one of the proprietors, obligingly showed it to me: and stated that he hoped to carry it into effect on the greatest scale ever yet imagined on the American Continent. Professor Morse, however, does not acknowledge that this system is susceptible of equality with his *telegraphic* alphabet for the purpose of rapid communication; and he conceives that there is an increased risk of derangement in the mechanism employed.

I cannot refer to the extent of the lines of the Electric Telegraph in America without an increased feeling of regret that in our own country this great discovery has been so inadequately adopted. So far, at least, as the capital is concerned, the two greatest of our railway companies have not, I believe, yet carried the Electric Telegraph further from London than to Watford and Slough: an enterprise measured in the United States by hundreds of miles being measured by less than scores in England.*

In England, indeed, we have learned the value of the Electric Telegraph as a measure of police in more than one remarkable case: as a measure of government it is not less important:—from the illustration which I have drawn from America, it is equally useful in commerce; but as a measure almost of social intercourse in the discharge of public business it is not without its uses also. The day before yesterday, I had an opportunity of examining the telegraph in the lobby of the House of Commons, by which communications are made to and from some distant Committee-room. As a specimen of the information conveyed from the House to the following:—"Committee has permission to sit until five o'clock;" and among the questions sent down from the Committee are the following:—"What is before the House?" "Who is speaking?" "How long before the House divides?"

* The Learned President has considerably underrated the extent to which the Electric Telegraph has been carried in this country. From the subjoined list, it will be seen that we have nearly 1,000 miles in actual operation:

	Miles.
[illegible] Counties—Colchester and Cambridge lines; Hertford, Ely, and Peterborough, and Thames Junction Branches	180
[illegible] Union—Colchester to Ipswich	17
[illegible] East—Brandon to Yarmouth	58
[illegible] Counties—main lines and branches	210
[illegible] North of England	54
[illegible] and Darlington—main line and branches	55
[illegible] Western—London to Slough	19
[illegible] Southern—main line and branches	152
[illegible] Eastern	99
[illegible]	5
[illegible] Devon	20
[illegible] and Peterborough	57
[illegible]—Extension to Milford	41
[illegible] South Midland	23
	990

Digitized by Google

DECIMAL NOTATION.

Sir,—in No. 1246 your correspondent, "W. O.," on decimal notation for *moneys*, does not explain his *new method* of writing shillings and pence. For 4s. 2d. he writes 42; for 14s. 5d. ··45; and for 12s. 10d. ··20. Now, as he neither states the scale nor radix of the quantities thus altered, it cannot be clearly understood how he finds the *amount* of the several given sums; nor does he explain how 10*l.* 11s. 11d. are *identical* with 10*l.* 11. If, as I suppose, he means that these figures having a small horizontal line over them are to be considered as quantities having *unity* prefixed, then they may be added in the usual way of finding the amount of sums in £ s. d. But, in my humble opinion, this would be rather a dangerous change; for, accidently, the wrong digit might be thus marked; or what would be equally bad, omitted altogether. But perhaps "W. O." will favour your readers with an explanation, as there may be more in his method than meets the eye.

I am, Sir, yours, &c.,
W. R.

Paddington, June 28, 1847.

ABATE'S SEWER TRAP.

Sir,—If your correspondent, J. L. Hale, Well-street, Hackney, wishes to try the correctness of his assertions respecting Abaté's Sewer Trap, he can do so by applying at the Society's house in the Adelphi, where the model sent has undergone a variety of severe tests and experiments before the Committee; the more so as it was sent in competition with others, and was not found subject to the fault he mentions, but on the contrary was so far successful. I expect that very much depends upon the proper proportions of the various parts in which Mr. Hale may have failed with his former trial, and I believe he will find the ball in this is not raised sufficiently high to occasion the descending water to take the form of a whirlpool; in washhand basins that was found to be the case, but not so as the present one is arranged. How far it will act satisfactorily has to be tried, and I understand is about to be so; but I am at present chiefly anxious to correct the error stated by you, "that neither Mr. Abaté nor the Society have ever tried this apparatus"—which is not the fact. I am, Sir, &c.,

E. B.

GUN-COTTON POWER ENGINE.

Mr. Fox Talbot has recently taken out a patent for the application of the explosive property of gun-cotton to produce a vacuum alternately on each side of the piston of an engine. At the bottom of the cylinder, on each side, are two circular holes in which the explosive material is supplied by a tubular slide. Passing through the cylinder is a platina wire, for the purpose of being excited by the galvanic battery, and thus explode the cotton. In preparing the cylinder, the tubular slide is first filled with gun-cotton, in each division thereof, so as to allow it to be exposed to the immediate action of heat in passing through the cylinder, by being brought in contact with the platina wire, taking care that one charge shall have been discharged before another is introduced—and thus causing, by repeated explosions, a motive power for giving motion to machinery, &c.; such power being regulated entirely by the quantity of explosive material employed.

RAILWAY ACCIDENTS AND LOCKED BUFFERS.

Sir,—Will you allow me a very brief space in your excellent journal to inform Sir George Cayley, Bart., that I have for a long time anterior to the first of March, 1847, conceived the idea of having locked buffers, though, like him, I delayed publishing the same until the 15th of the present month, when I addressed the following letter to the Editor of the *Times*, and which appeared in that journal on the 16th:—

"*To the Editor of the Times.*

"Sir,—In the excellent letter of an 'Engine-driver,' which appeared in your columns last Monday, it is stated that much danger is to be apprehended from the buffers not meeting each other at their proper centres, in a case of collision. Why not remove this cause of apprehension and danger, by having the buffers made concave at one end and convex at the other? This plan would certainly facilitate their meeting at proper centres, if not altogether remove the possibility of a repetition of the dreadful loss of life which took place at Wolverton.

"June 15. CYMRO."

Therefore, I hope that Sir George will concede to me the *priority of publication*, and share the *honours of invention*.

I am, Sir, &c.,
O. R—l—d.

June 26th, 1847.

YATES' PATENT IMPROVEMENTS IN BLAST FURNACES.

[Patentee, Mr. James Yates, Masborough, Yorkshire. Patent dated December 14, 1847.]

The patentee states, that it is usual to keep the charge, in blast furnaces of ordi-

Digitized by Google

nary construction, for as long a time as is compatible with the iron made; and that it is deemed beneficial to continue *the cementing process*, which is the result of the iron-stone, or ore, and fuel, being subjected to a great degree of heat for several days; but that he believes this system of operation to be erroneous.

Again; under the system which has hitherto prevailed, furnaces are kept filled up to the funnel-head, through which the flame and unconsumed products pass on escaping from the charge; and these furnaces are constructed in the form of two cones united at their bases, or of a cylindrical form at top; both of which forms of construction offer scarcely any obstacle to the free escape of caloric with the unconsumed products.

Now Mr. Yates proposes *firstly*, to arch in the upper part of the furnace, and diminish its height, in order that a very considerable portion of heat, instead of escaping as heretofore, may, after striking against the even surface of the dome, be deflected on the top surface of the "burden" and absorbed by it. *Secondly*, to place feed-doors, by which the material may be introduced in the side, at that point of junction between the dome and the bottom part of the furnace which allows of the largest surface of the burden being exposed to the action of the deflected heat (care being taken to maintain a sufficient and uniform space between the dome and top of the "burden" for the purposes of reverberation); by which mode of charging the furnace the "burden" is hollow in the centre, and therefore offers less resistance to the blast, which is regulated by means of dampers suitably placed in the chimney. And *thirdly*, to employ a greater number of tuyeres, and to distribute them more equally round the hearth of the furnace than has yet been customary; and to provide each tuyere with a separate house, in order that the blast may act more regularly on the "burden."

The results of these alterations are stated to be saving in the prime cost of erection, and economy both in fuel and in engine power.

Mr. Yates instances a furnace, built according to his invention, which was 20 feet from the hearth to the top of the "burden," and had six tuyere pipes of $\frac{7}{8}$ths of an inch in diameter; with this furnace he produced, employing a hot blast at a pressure of $1\frac{1}{2}$ lbs. to the square inch, 110 tons of iron, from lean Derbyshire ore, in one week.

The patentee proposes to adapt his plan of construction to existing furnaces, by building the dome in the top, or other part of the shaft, and providing feed doors, together with the necessary holes for the extra number of tuyere pipes.

After pointing out various modifications of which his invention is susceptible, such as, the substitution for tuyere pipes, of a circular passage, with grating to keep in the "burden," Mr. Yates proceeds to describe a peculiar apparatus for feeding by the chimney instead of by side doors, which enables him to obtain the same result, viz., the distribution of the material around and upon, and not in, the centre of the "burden." The apparatus referred to is fixed in the dome, and consists of a cone, having an aperture in its centre for the passage of unconsumed products, and is adjusted to the required size. The cone is made fast to a lever passing through the chimney, and weighted at the outside end; so that when there is no disturbing force, its weight shall keep the cone wedged tight up into the dome, and leave no room for the escape of any vapour or caloric, except through the aperture. A feed-box is suspended in the chimney, and has a conical bottom, similarly connected to a weighted lever, which, when the box is filled, falls down, and allows the passage of the material; the centre aperture of the under cone being covered by the bottom of the feed-box. The weight of the material falling on the surfaces of the under cone, overcomes the weight at the end of the lever, and depressing the cone, passes into the furnace, around the sides. When there is no longer any weight on either the cone portions of the dome, or the conical bottoms of the box, they both return to their places.

Other modifications described in this specification are, the connecting two or more furnaces to a common chimney, by flues provided with dampers to regulate the draught: the making the furnace of as great a diameter at the bottom, just above the hearth, as at the other point of junction with the dome, or even greater: and a peculiar construction of tuyere box, to avoid, in a great measure, the melting of the tuyere pipes.

The patentee describes, lastly, some improvements relating to steam-engines and cylinders employed in blasting, which may be said briefly, to consist in working two engines together, by connecting the slide valves and rods of the one to the piston-rod of the other, and *vice versâ*; so that the piston at work shall open the valves of the one at rest; and in using an elastic cylinder attached immovably at one end to the main, and at the other to the piston-rod. By the use of this elastic cylinder, Mr. Yates states that a more regular pressure of the blast may be obtained.

Digitized by Google

NOTES AND NOTICES.

Magic Mirrors.—An interesting paper was read at a late meeting of the Paris Academy of Sciences, by M. Stanilas Julian, on the metallic mirrors made in China, and to which the name of "Magic Mirrors" has been given. Hitherto all attempts by Europeans to obtain information as to the process, in the localities where they are manufactured, have proved failures; some of the persons applied to being unwilling to reveal the secret, and others being ignorant of the process. These mirrors are called magical, because if they receive the rays of the sun on their polished surface, the characters, or flowers *en relief*, which exist on the other side, are faithfully reproduced. The following information has been obtained by M. Julian, from an author named Ou-tseu-hing, who lived between 1260 and 1341. This author says:—"The cause of this phenomenon is the distinct use of fine copper and rough copper. If, on the under side, there be produced, by casting in a mould, the figure of a dragon in a circle, there is then engraved deeply on the disc a dragon exactly similar. Then the parts which have been cut are filled with rather rough copper, and this is, by the action of fire, incorporated with the other metal, which is of a finer nature. The face of the mirror is next prepared, and a slight coating of tin is spread over it. If the polished disc of a mirror so prepared be turned towards the sun, and the image be reflected on a wall, it presents distinctly the clear portion and the dark portion, the one of the fine and the other of the rough copper." Ou-tseu-hing states that he had ascertained this by a careful inspection of the fragments of a broken mirror.

Etherization of Vegetables.—M. Clemens, Professor of Natural Sciences at the College of Vevay, has lately addressed a memorial to the Academy of Sciences of the Vaud, giving the results of experiments made by him in order to ascertain the effects of ether upon vegetables; from which he finds plants may be etherized as easily as man and other animals. He says:—Take a branch of the *berberis vulgaris*, the common barberry, and put it under a drinking-glass, with a small quantity of ether, for a minute at most if in the sun, and during three minutes at most if in the shade, but at at a temperature of not less than 12 degrees of Reaumur (59 degrees Fahrenheit); and when it is withdrawn, it will be found, on touching the stamina at their base, that they have lost all their irritability, which will not return in the first instance until after a considerable time, the influence of the ether having been much stronger. In the second case, on the contrary, the primitive irritability is recovered in half an hour. The plant may be etherized a second time; and this second etherization must not be any longer than the first; and after half an hour the plant resumes all its vigour. To etherize a sensitive plant, *mimosa pudica*, the process must be continued for 8 or 10 minutes, and a proportionably longer time in the shade. The acetic, chlorhydric, and nitric ethers act in the same manner; but the sulphuric and acetic ethers are the most effective.

LIST OF ENGLISH PATENTS GRANTED FROM JUNE 26, TO JUNE 29, 1847.

Robert Wilson, of Low Moor Iron Works, Bradley, Yorkshire, engineer, for improvements in machinery and the arrangements thereof for forging, stamping, punching, cutting, and pressing metals and other substances. June 26; six months.

Ureli Correlli Hill, of New York, U. S., professor of music, for a mode or modes of producing musical sounds. June 28; six months.

William Edward Newton, of Chancery-lane, civil-engineer, for certain improvements in manufacturing wheels. (Being a communication.) June 28; six months.

Henry Hornblower, of Dalgleish-place, Commercial-road, Middlesex, engineer, for certain improvements in obtaining motive power. June 28; six months.

Frederick Chaplin, of Bishops Stortford, Hertfordshire, tanner, for improvements in wheels for railway carriages. June 29; six months.

Thomas Young, of Queen-street, Cheapside, merchant, for improvements in card cases and retaining or fastening papers, deeds, and fabrics. June 29; six months.

Paul Gilbert Prelier, of Rue de Rivoli, Paris, gentleman, for improvements in the manufacture of dry sulphuric acid, and in the manufacture of smoking or Nordhausen sulphuric acid. (Being a communication from abroad.) June 29; six months.

MONTHLY LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 24TH OF MAY TO THE 21ST OF JUNE, 1847.

Reginald James Blewitt, of Llantarnam Abbey, Newport, Monmouth, esq., for improvements in the manufacture of malleable iron. May 24.

Solomon Leatham, of Leeds, York, overlooker, for improvements in roving and spinning flax and other fibres. May 24.

Christian Schiele, of Frankfort-on-the-Maine, but now of Manchester, Lancaster, mechanician, for certain improvements in machinery or apparatus for condensing steam, which said improvements are also applicable to other similar purposes. May 28.

Jean Marie Fourmentin, of New Bridge-street, Blackfriars, gent., for improvements in the manufacture of carbonate of lead. May 28.

Thomas Bartlett Simpson, of Threadneedle-street, London, gent., for certain improvements in propelling, and in machinery employed therein. June 2.

Edmund Morewood, of Thornbridge, Derby, merchant, and George Rogers, of Sterndale, in the same place, gent., for improvements in the manufacture of iron into sheets, plates, or other forms, in coating iron, and in preparing iron for coating and other purposes. June 7.

George Augustus Huddart, of Brynkir, Carnarvon, esq., for certain improved apparatus for the cultivation of land. June 7.

John Hill, of Hulme, near Manchester, Lancaster, machine maker, for improvements in looms for weaving certain kinds of cloth. June 9.

Francis Bowes Stevens, of Haboken, Hudson, in the State of New Jersey, in the United States of America, engineer, for improvements in applying means and apparatus to ships and vessels to improve their speed. (Being a communication from abroad.) June 9.

Elijah Galloway, of Buckingham-street, Strand, Middlesex, civil engineer, for improvements in rotary engines, and in locomotive carriages, railways, and wheels for carriages. June 11.

John Lane, of Oriel-street, Liverpool, brewer, for improvements in railway carriages and engines. June 11.

Alfred Vincent Newton, 66, Chancery-lane, Middlesex, mechanical draughtsman, for improved apparatus to be applied to steam boilers. (Being a communication from abroad.) June 11.

John Healey, of Bolton, Lancaster, machine maker, for a new and improved woven fabric, and also for certain improvements in machinery for producing the same. June 15.

Charles Larrad, of Leicester, machinist, for improvements in machinery for cutting wood for the manufacture of bobbins and other articles. June 16.

Thomas Russell Crampton, of the Adelphi, Middlesex, engineer, for improvements in locomotive engines. June 15.

Alfred Brett, of Holborn-bars, gent., and George Little, of High Holborn, electrical engineer, for improvements in electric telegraphs, and in arrangements and apparatus to be used therein and therewith, part of which improvements are also applicable to time-keepers and other useful purposes. June 15.

Digitized by Google

Pierre Frederic Gorigy, of Leicester-square, Middlesex, gent., for improvements in apparatus and machinery for raising, lifting, and otherwise moving heavy bodies. June 16.

Samuel Kenrick, of Handsworth, Stafford, iron founder, for certain improvements in preparing or forming moulds for casting metal. June 18.

George Taylor, of Holbeck, near Leeds, York, for mechanic improvements in the construction of engines and carriages to be used on railways. June

Frederic Theodore Philippi, of Bellfield Hall, Lancaster, calico printer, for certain improvements in machinery or apparatus for stretching and finishing woven fabrics. June 18.

Francis Preston, of Ardwick, near Manchester, spindle maker, for certain improvements in machinery or apparatus to be used in the preparation of cotton and other fibrous substances for spinning. June 21.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
June 24	1106	E. Looms and W. P. Stanley	Whittlesea, Cambridgeshire... Peterborough, Northamptonsh	Improved hand seed-dibble.
25	1107	James Cocks	18, Allen-street, Lambeth	Day and night signal.
,,	1108	Henry Greaves	Birmingham	Treble lock-frame for carpet and other bags.
26	1109	James Furrell	Vicarage-place, Kensington	File for filing papers.
,,	1110	John Paltrinerl	4, South-street, Finsbury	Binding needle.
28	1111	Henry and John Gardner	453, Strand, lamp manufacturers	Candle-shade holder support.
,,	1112	John Cornes	Barbridge, near Nantwich, Cheshire	Improved chaff engine.
,,	1113	George Oxley	19, Old Nicholl-street, Churchstreet, Bethnal Green	Ottoman music-stool.
29	1114	John Masters	Welford-place, Leicester	Waistcoat back-strap.
,,	1115	Henry Barber	Davis-street, Oxford-street	Double-bottomed pan for a shower-bath.

Advertisements.

TO MINE AND COLLIERY PROPRIETORS, SLATE QUARRY OWNERS, RAILWAY CONTRACTORS, IRONMONGERS, DEALERS IN GUNPOWDER, AND OTHERS.

MESSRS. JOHN HALL AND SON, THE PATENTEES AND SOLE MANUFACTURERS OF

SCHONBEIN'S PATENT GUN-COTTON,

Respectfully state, that they are now prepared to SUPPLY the PATENT GUN-COTTON (compressed for the convenience of carriage), in round and square paper cases, of 4 ozs. each, packed in boxes, containing 50 and 100 cases each, at the price of 3s. per lb., for ready money.

Also, in tubes or cartridges of... 1, 1½, 1¾, and 1¼ inch diameter;
Containing ..... 2, 4, 6, and 8 ounces each, at the
Additional charge of..... 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 3 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

Office, 23, *Lombard-street, London.*

Published this Day, price Five Shillings,

Microscopic Objects—Animal Vegetable, and Mineral.

CONTENTS.

Catalogue of Microscopic Objects.
Recent Improvements in Microscopes.
Observations on the Catalogue of Microscopic Objects.
Test Objects.
Animals and Plants exhibiting Circulation.
Microscopic Objects by Polarized Light.
Preparing and Mounting Microscopic Objects.
Microscopic Fragments.
Achromatic Microscopes.
The Megaloscope (a new Optical Instrument).

WHITTAKER and Co., Ave Maria lane.

Baldness Effectually Removed.

A SURGEON, residing in Cork, having, in the course of his practice, had his attention particularly directed to, and acquired great experience in, the treatment of capillary diseases, is happy to inform those persons afflicted with baldness (whether in youth or advanced life), that they may, by a most simple process, reproduce that necessary ornament—a fine head of hair. Parties applying will require to inclose a small quantity of hair, and a fee of Half-a-Guinea, by Post-office order, in favour of Surgeon EDWARD WILLIAMS, 13, Henry-street, Cork, when the necessary instructions will be forwarded by return of post.

Just published, Price 6d.,

A LETTER, by G. V. GUSTAFSSON, to the Editor of the "Practical Mechanic and Engineers' Magazine." Being a reply to his Review of "Practical Observations on the Present State of the Steam Engine." By the Same Author.

London: G. HEBERT, 88, Cheapside.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs T. Burnell and Co., 1, Great Winchester-street, London.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

CONTENTS OF THIS NUMBER.

Bain's New System of Electro-Telegraphic Communication. The specification verbatim—(*with engravings*) 25
Remarks on the Use of Mathematical Knowledge to Engineers, and Hints to those who have not the Benefit of a Tutor—(*continued*) 31
Geometry of the Line and Plane. By T. S. Davies, F.R.S. and L.E., F.S.A., Royal Military Academy, Woolwich 34
Notes on the Demonstration of the Parallelogram of Forces in Poisson's Mechanics 38
Reply to the Rev. Thomas P. Kirkman's Remarks on certain Mathematical Prize Questions. By W. S. B. Woolhouse, Esq. 40
Adcock's Patent Spray-pump 41
Poole's Improvements in Electro-Telegraphy 41
Railway Buffers 43
Lighting by Electricity, Signal Lamps, and Staite's Patents 41
Abate's Sewer Trap 44
Patent Law Cases—Defective Specifications:—
Croll *v.* Edge 45
Beard *v.* Egerton and others 45
The "Vassitei Tidjaret" 46
The South Western Steam Navigation Company 46
Weekly List of New English Patents 46
Weekly List of Articles of Utility Registered 46
Advertisements 47

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,

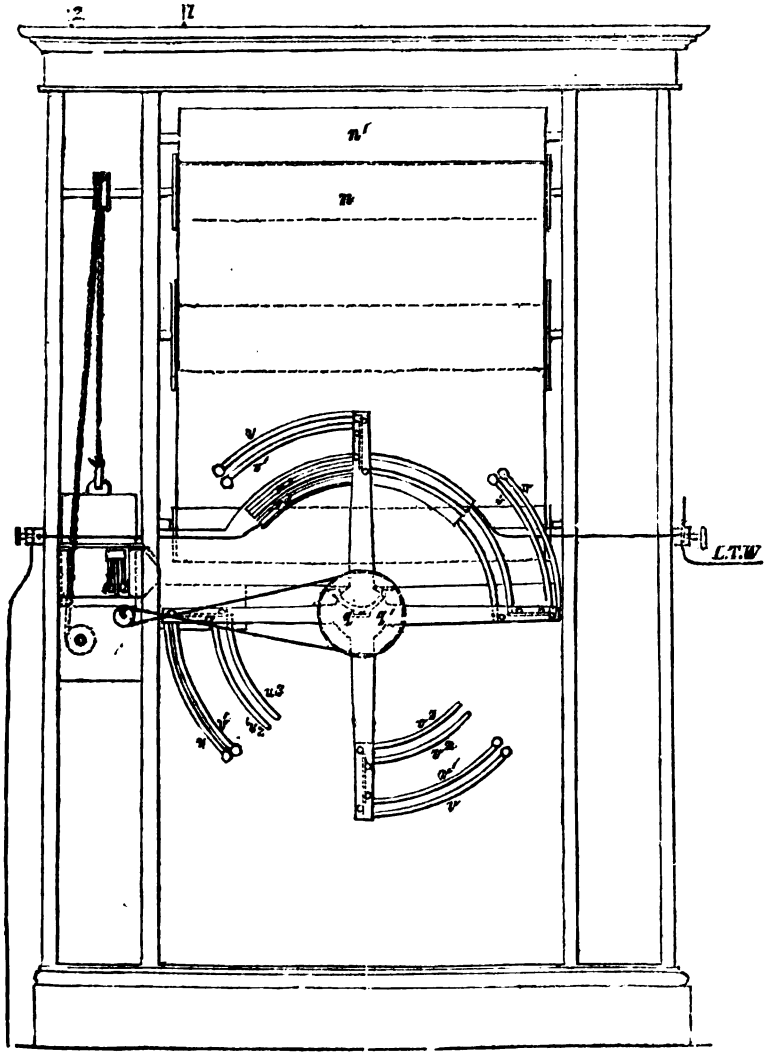
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1248.] SATURDAY, JULY 10. [Price 3d.

Edited by J. C. Robertson, 166 Fleet-street.

BAIN'S NEW SYSTEM OF ELECTRO-TELEGRAPHIC COMMUNICATION.

Fig. 4.



Digitized by Google

MR. BAIN'S NEW SYSTEM OF ELECTRO-TELEGRAPHIC COMMUNICATION.

(Continued from p. 31.)

Second Arrangement.

I will now describe another arrangement of apparatus for transmitting and receiving communications by electrical means, such apparatus being arranged for transmitting and receiving communications at intervals, the apparatus both for transmitting and for receiving remaining quiet when not required for transmitting a communication.

The apparatus is, however, so arranged that, when in work, mechanically composed communications may be transmitted with far greater rapidity than by any other arrangement, or system, of electrical telegraphic communication heretofore used, or proposed, owing to the circumstance of dispensing with the use of magnets, and having continuous motion, both in respect to the mechanical composed form, and also in respect to the receiving surface, and also in respect to the marking instrument.

The apparatus according to my invention dispensing with the step by step motion consequent on the use of magnets heretofore employed, either for giving or governing the motion of the receiving surface as in Davy's, and also in my former apparatus, or for giving or governing the motion of the marking instrument, as in Morse's apparatus before mentioned. Fig. 7 is a side view, and fig. 8 shows a plan of an apparatus for transmitting and receiving communications by electric means.

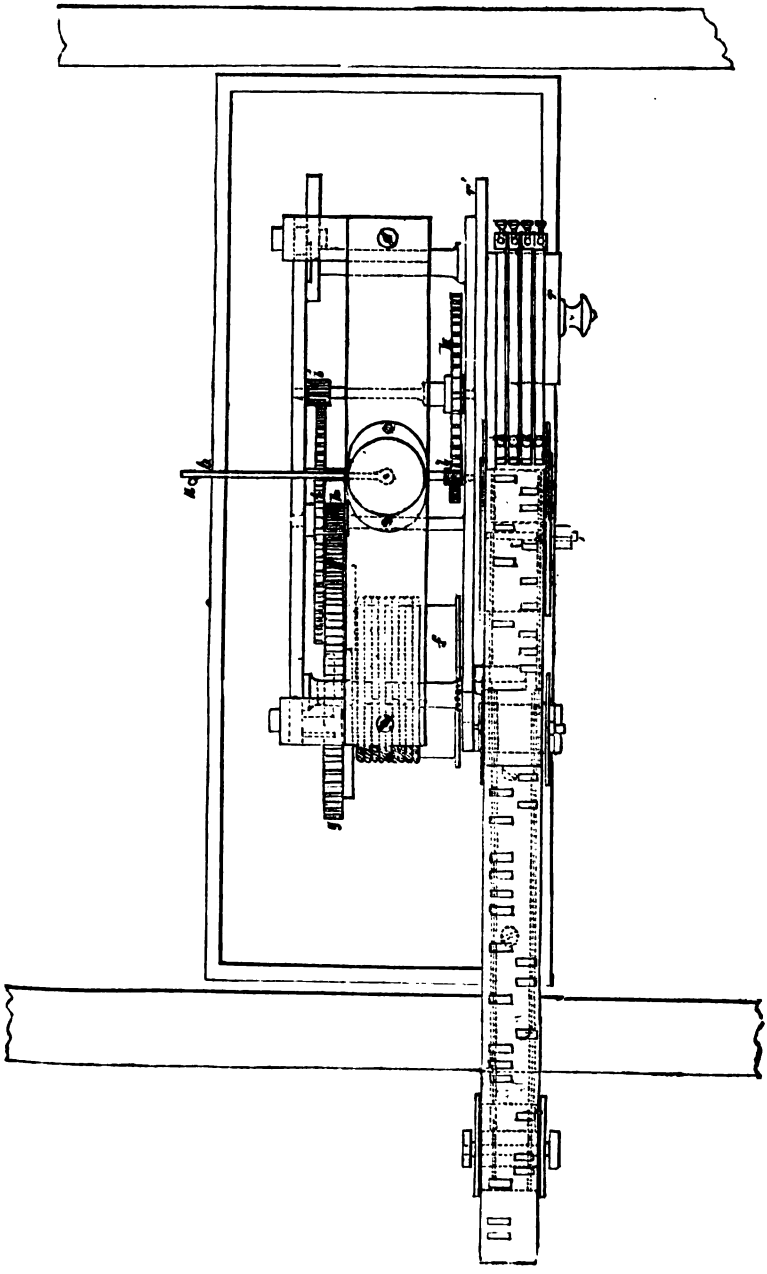
Fig. 9 shows a plan; fig. 10 is an end elevation; and fig. 11 is a front view of the apparatus.

Fig. 12 showing two distant apparatus (connected by a long telegraphic wire) such as are used for transmitting, and also for receiving communications; the apparatus at each end being such as to be used either for transmitting or receiving a communication; and I recommend that the apparatus at both ends, or at the two distant places, should at all times be in a condition to receive a communication, and if the party attending to either of the apparatus be desirous of making a communication, then to remove the prepared paper, and to introduce the mechanically composed form of the communication he desires to transmit, the present apparatus being used to transmit a communication from paper, and to receive it on chemically prepared paper; hence the same instruments are applicable at both ends, and the apparatus at each end, when at work, is to be kept in motion at corresponding rates by mechanical means: I prefer to do so by clockwork, such as is shown, by which arrangement the mechanically prepared paper having the communication, will be moved continuously during the transmission of a communication therefrom, at the same speed, or as nearly so as may be, as that of the chemically prepared surface at the other end of the apparatus, at a distant place. The apparatus shown at figs. 7, 8, 9, 10, 11, and 12, are suitable for being worked by one telegraphic wire, using the earth as the means of completing the circuit, as is now well understood. I will suppose that the communication is to be made from the apparatus marked London, and received at the apparatus marked Edinburgh. The apparatus is so arranged as to be held by a stop, or detent, which may be moved out of the way by means of an electric current, put in motion by the person making the communication; as is well understood, and now commonly practised, when removing a detent or stop, for allowing an alarum to get into motion.

The consequence of removing such detent or stop *a*, out of the way of the arm *b* of each apparatus, will be, that the descent of the weight *c* of each apparatus will be no longer restrained, and will begin to descend, and the wheel-work of each apparatus will be simultaneously put in motion, and will remain in motion so long as the stop *a* is out of the way of the arm *b*, the arm being affixed on the axis *d*, moves round with it. Motion is communicated from the weight *c* by means of the cord *e*, which is wound on the barrel *f*, on the axis of which is placed the cog-wheel *g*, the catches f^1 taking into the ratchet-wheel fixed on the barrel *f*, fix the barrel and the cog-wheel *g* together, yet allow of its being turned to wind up the cord, the cog-wheel *g* takes into and drives the pinion *h*, on the axis of which is fixed the cog-wheel *i*, which takes into and drives the pinion *j*, on the axis of which is fixed the cog-wheel *k*, which takes into and drives the pinion *l*, on the axis of which is fixed the bevelled tooth wheel *m*, which takes into and drives the bevelled toothed-wheel *n*, which is on the axis *d* of the governor, which is similar to what has heretofore been used; the expanding arms of the governing balls being adjusted or controlled by raising or lowering the external tube d^1, within which the upper parts of the arms revolve. The paper, whether it be the chemically prepared paper, or the one having the mechanically composed communication, is to be placed on the barrel of the axis (1), and it is conducted over the barrel *o* on the axis *l*, thence over the roller (2), thence over the

Digitized by Google

Fig. 9.



Digitized by Google

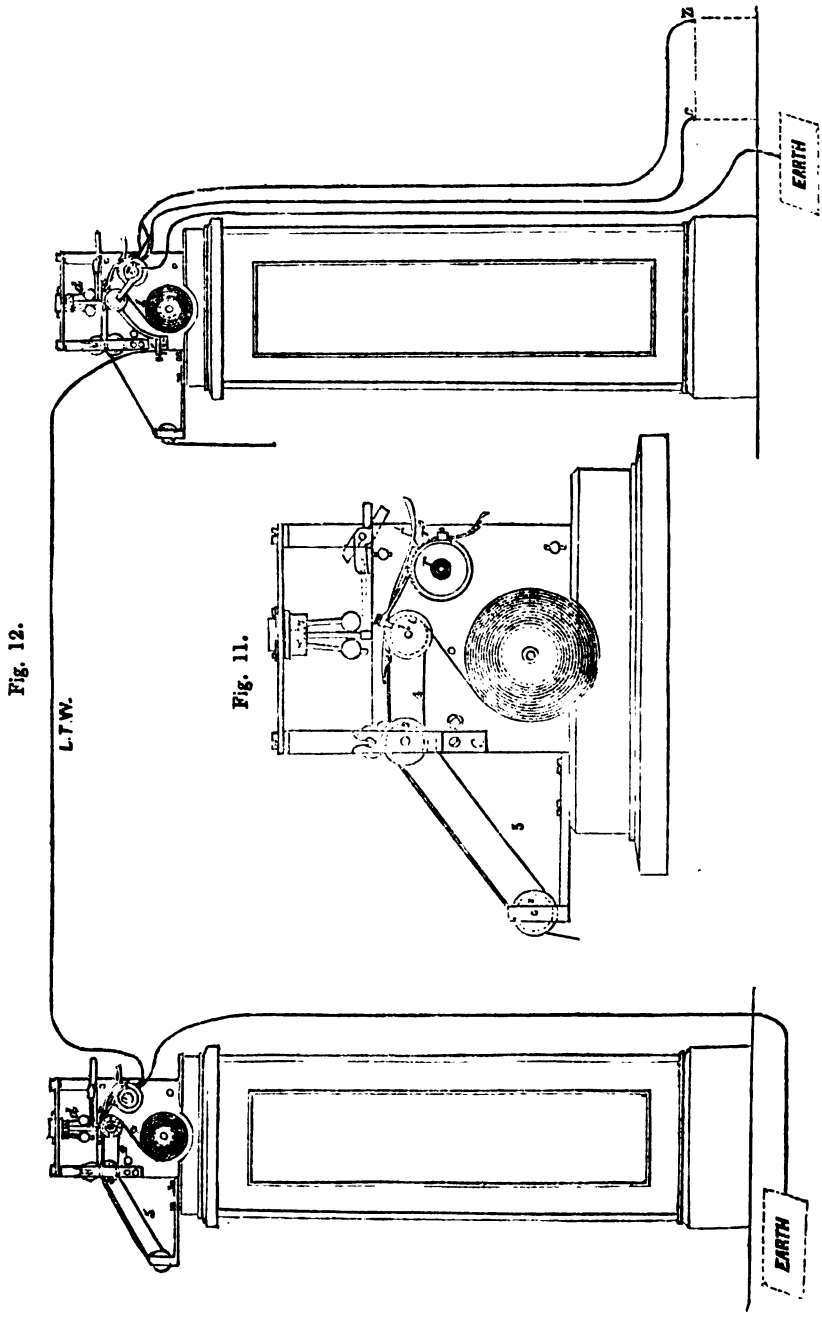


Fig. 12.

Fig. 11.

Digitized by Google

EDINBURGH. Fig. 8. LONDON.

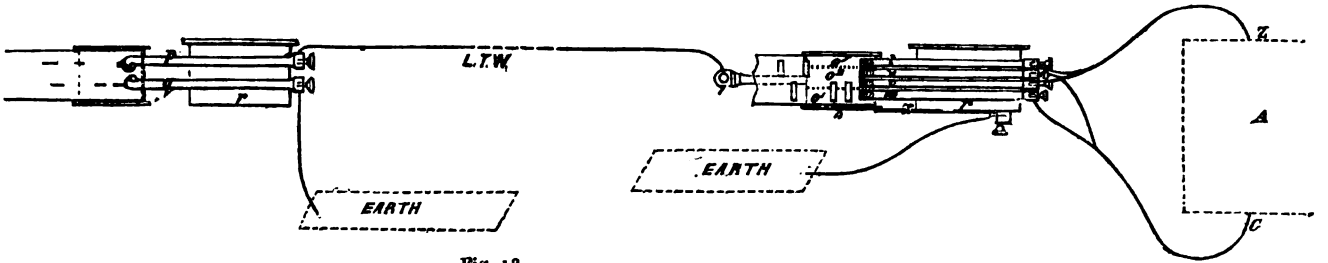


Fig. 13.

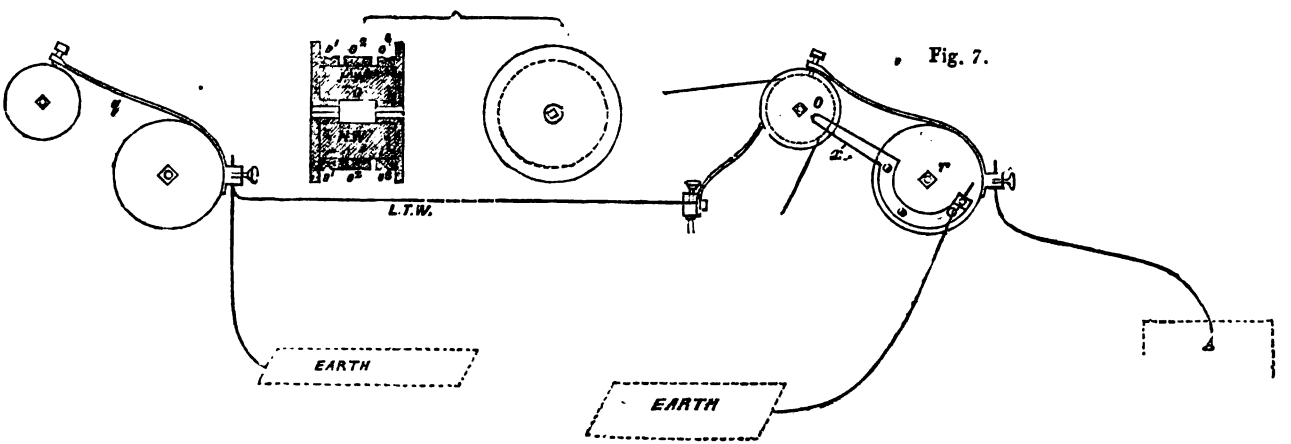


Fig. 7.

Digitized by Google

roller (3); and to facilitate the movement of the paper, and to support it, there are grooves formed in the barrel *o*, also in barrels (2) and (3), in which endless India-rubber bands are applied, as shown at (4) and (5). On the axis of the pinion *l* is fixed the barrel *o*, shown in section separately at fig. 13, which is composed of three parts o^1 o^2 o^3, the part o^2 being insulated from the other two parts, the other part o^1 o^3 being in metallic communication with each other.

(*To be continued.*)

ETHERIZATION—THEORY PROPOSED.

Respected Friend,—The modern discovery of producing insensibility to pain, by the inhalation of ether, has given rise to various speculations, as to the cause of such apparently wonderful effects; but thus far the sum total of what has been said on the subject, amounts to no more than that the vapour acts on the muscles and nerves which produce sensation—as if all the nerves were not alike in that respect. In my opinion, this phenomena is simply the result of cold, caused by the rapid evaporation of the ether, which has come in contact with the nerves, by inhalation; the cold producing a numbness, or inanition, throughout the nervous system, as soon as the vapour has acted on the brain,—the brain being the root of the nerves. That this is the cause of insensibility may be almost proved by a simple experiment: if the hand is immersed in ether, and then exposed to the atmosphere, a sensation is produced almost instantly, which is so singular that we scarcely know whether it is cold or a burning heat. This arises simply from the cold being produced on the skin by the sudden evaporation of the ether, while the blood beneath is still warm. Now, in inhaling ether, the vapour is rapidly transfused over the nerves, and as rapidly evaporated, the heat being by this operation abstracted; and as soon as its effects have extended to the brain, life is, as it were, suspended in the nervous system: for life is soon extinguished if heat is entirely abstracted from the body. This view of the subject would explain in a simple manner the cause of the operation having proved fatal in some cases; the body, previously weakened by disease, does not possess the power of recovering the heat which it has lost, and thus becomes gradually cold, until life is extinct. If this theory is correct, we may suppose it possible to prevent such results, by applying heat, after operating, either externally or by electricity. The latter would be, probably, the best mode, as the most expeditious; but it must be evident that it is imprudent to continue the inhalation during a long period, after the system has been exhausted by emaciation and suffering.

I suppose that many other fluids might produce the same results; but the rapidity with which sulphuric ether evaporates, must render it safer than any other, when used by inhaling it. It is probable that the cause of spirits of turpentine curing a burn on the skin is by its abstracting the heat in evaporating; so that ether would, without doubt, answer better for this purpose also. It may be worth a trial, as its success would confirm the truth of the above theory.

These speculations may lead to the question—What is mesmerism? The world is so divided on the subject, that one would be led to suppose it difficult to settle the matter; the medical world, on the one hand, denouncing it as a delusion; and the mesmerists, on the other, asserting it to be a mysterious agent, the effects of which they suppose are sufficiently unlike those produced by other causes, to lead to the conclusion that it has nothing in common with etherization. That insensibility to pain has been produced by its means can hardly be doubted; yet this is no reason for magnifying a really simple phenomena into a mysterious principle, for the purpose of exciting the wonder of the ignorant. I would suppose that the operator does nothing more than abstract heat from the nerves, by what is mysteriously termed, "the passes;" or in other words, the heat, in circulating through the body, is arrested on the weaker nerves, by the influence of another individual of a stronger frame, but not by the aid of the imagination. The fact of nervous diseases having been partly removed by mesmerism, is simply due to the mental consciousness of pain being temporarily removed through partially disconnecting the mind from the brain; by stopping the usual functions of the nervous system; and whether this is effected by inhaling ether, or by the

Digitized by Google

influence of the hand on the nerves of the individual, the effects are, in reality, nearly the same, however different they may apparently be; but the ether acts in nearly all cases with certainty, while by the mysterious process the reverse is frequently the case. It is probable that the mesmerists will not acknowledge that this is the philosophy of the thing, after having proclaimed it as the source of everything wonderful under the sun. A definition so simple is something like breaking the magic lantern, or like analysing a universal medicine, and showing its principal ingredient to be nothing more than flour; the mystery having disappeared, there is no magical power remaining.

In support of the above it may be remarked that *cramp*, which is the result of cold on the nerves, almost entirely destroys the consciousness of external injury, while, if it reaches the lungs or stomach, life is soon extinguished by checking, in all probability, the circulation of heat through the nerves. We might thus trace many apparently different effects to the same cause—absence of heat.

A result of etherization which deserves attention is, that while all physical sensation is lost, the faculties of the mind are apparently stronger than at other times, the mind being then in a perpetual whirl of thought. This seems to be the result of the mind being rendered temporarily independent of the body, through the immobility of the nervous system; but no sooner is physical sensation restored, than this extraordinary state ceases, and the mind being chained to matter, its power is again limited. This proves, that far from matter being essential to the existence of mind, it is the prison of the mind; consequently, that from the moment the mind becomes totally independent of matter, the faculties have free scope, and expand to an infinitely greater extent. Yet strange as it may appear, the greatest advocates of mesmerism are materialists. Let these inconsistent theorists, and their brother sceptics, examine the subject more deeply than they have hitherto done, and they will see that what is really science is too simple to aid the propagation of the principles which they advocate.

Would not the above theory be confirmed by that advocated by Dr. Payerne in your pages,—cold is the result of the chemical repose of bodies, (or matter,) heat of their animation or mobility?

I remain respectfully,

JOHN DE LA HAYE.

Liverpool.

THE CENTURION PAPERS.—No. 1.

Our readers were some time ago apprized that a considerable number of papers left by the correspondent who signed "Centurion" in our pages, had been communicated to us by his son. Amongst these are many curious investigations relating to isolated geometrical, and other problems and theorems; some more complete dissertations; and a not inconsiderable number of physical and metaphysical researches. We shall, as we promised, give selections from all these from time to time, as occasion serves; beginning with the briefer and more isolated propositions — though holding ourselves at liberty to depart presently from this plan, for the sake of variety.—ED. M. M.

---

1. *The "Flat Knot."*

All the world knows that from time immemorial, there has existed a method of "tying up a note" in what has been appropriately called a flat knot. Nobody, perhaps, had thought of the geometrical character of this knot, till a few years ago, it was proposed in one of the Trinity College papers (1833), to show that the knot itself was a regular pentagon. No proof of this, though admitted on all hands as a truth, has been published—at least as far as I have been able to discover. The following method, however, does prove it; and that, perhaps, as simply as it can be done:

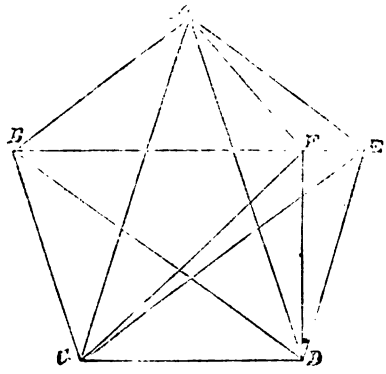
1. No smaller number of folds than five will make a complete tie. The figure must, therefore, be a pentagon of some kind.

2. Each angular point of the tie must coincide with one or other of the parallel edges of the slip of paper.

3. If the diagonals of a regular pentagon be drawn, each will be parallel to the side of the pentagon, which is non-contiguous to it; and all the trapezoids so

Digitized by Google

formed will be equal and similar. Thus,



BE is parallel to CD, AC to DE, and so on; and the trapezoid BCDE is similar and equal to ACDE, and similarly to all the others.

4. If a pentagon be not regular, these conditions are not fulfilled.

For, let us take the most favourable case for its fulfilment; viz. that AB, BC, CD, are three of the sides of a regular pentagon; and the remaining angular point F be situated in BE, E being the fifth angular point of the *regular* pentagon. Join CF.

Then CE is parallel to AB; and by our contra-hypothesis, CF is also parallel to AB; whence CE, CF are parallel. But they meet in C; which is absurd.

Wherefore, in no pentagon but a regular one can all the diagonals be parallel to the non-contiguous sides of the figure.

5. Since by the hypothesis of the theorem, every diagonal and every side are one or other of the parallel edges of the slip of paper; and since by what has been shown in (4), this condition can only be fulfilled when the pentagon is *regular*; it follows that the "flat knot" cannot be other than a regular pentagon, as affirmed in the proposition. Whence, *etc.*

[*Note.*—We observe that this problem is also proposed in Mr. Pott's very excellent edition of Euclid, as an exercise upon the fourth book.—Ed. M. M.]

2. *Tri-rectangular Pyramid.*

(α) A triangular prism has its three angles at the vertex right angles: show that the sum of the squares of the areas of its three faces are together equal to the square of its base.

(β) If the three edges of the pyramid be $\sqrt{3}$, $\sqrt{5}$, $\sqrt{7}$; find the area of the base and the volume of the pyramid.

Solution.

(α) Put a, b, c for the three edges: then, their faces will be $\frac{1}{2}ab$, $\frac{1}{2}bc$, $\frac{1}{2}ca$; and the edges of the base will be

$$\sqrt{a^2+b^2},\ \sqrt{b^2+c^2},\ \sqrt{c^2+a^2}.$$

Whence (Hutton's Course, 12 ed., p. 473,) we have

$$\text{area}^2 = \tfrac{2}{16}\{(a^2+b^2)(b^2+c^2)+(b^2+c^2)(c^2+a^2)+(c^2+a^2)(a^2+b^2)\}$$
$$-\tfrac{1}{16}\{(a^2+b^2)^2+(b^2+c^2)^2+(c^2+a^2)^2\}$$
$$=\tfrac{1}{4}(a^2b^2+b^2c^2+c^2b^2).$$

Also, the sum of the squares of the three faces, from the formulæ above, is the same quantity. Whence the theorem is proved.

(β) By the preceding, we have

$$\text{base} = \sqrt{3+6+7} = \sqrt{16} = 4.$$
$$\text{vol} = \tfrac{1}{3}\text{ area of one face by the remaining edge}$$
$$= \tfrac{1}{3}\cdot\tfrac{1}{2}\sqrt{3.6}\cdot\sqrt{7} = \tfrac{1}{2}\sqrt{14}.$$

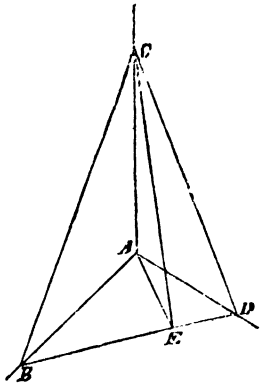
Scholium.—The theorem (α) was first noticed by Monge, who gave it in his *Géométrie Descriptive*, and a demonstration of it has been given in some English works, something after the manner of the ancient geometers. Vide "Davies's Solutions of Hutton's Questions," p. 335. It has not, I think, however, been anywhere treated as in the solution above.

Digitized by Google

Editorial Note.—As Mr. Davies's Solution is referred to by our friend of valued memory, we copy it into our pages; convinced that it will be interesting to those of our readers who may not be able to consult a now somewhat rare work, which we know occupied much of the time of one of the most valued contributors to this Magazine. Our friend very properly uses the phrase, "something after the manner of the ancient geometers" in describing such proofs: but in fact, the principle of the enunciation of the theorem itself was not recognised—nay, was even rejected by the illustrious fathers of the science—and hence there can be no closer analogy to their methods in the demonstration than there is in the enunciation. The school of Euclid would, probably, have given it in a form not essentially unlike this:—"If four lines be taken proportional to the three faces and the base of a pyramid, whose three angles at the summit are right angles: then the sum of the squares of the first three lines is equal to the square of the fourth." But we proceed to the solution in question.

"Let AB, AC, AD be three edges of the pyramid, whose base is BCD, and the three vertical plane-angles at A right angles. From A draw AE perpendicular to BD and join CE. Then CE is perpendicular to BD (theor. 102).

"Now in the right-angled triang e BAD, we have



$$BA \cdot AD = BD \cdot AE, \text{ or } BA^2 \cdot AD^2 = BD^2 \cdot AE^2.$$

"Again, $CA^2 \cdot AB^2 + DA^2 \cdot AC^2 = CA^2(AB^2 + AD^2) = CA^2 \cdot BD^2$;

Hence adding,

$$BA^2 \cdot AD^2 + DA^2 \cdot AC^2 + CA^2 \cdot AB^2 = BD^2(AE^2 + AC^2) = CE^2 \cdot BD^2.$$

"Now $BA^2 \cdot AD^2 = 4(\triangle BAD)^2$

$DA^2 \cdot AC^2 = 4(\triangle DAC)^2$

$CA^2 \cdot AB^2 = 4(\triangle CAB)^2$

$CE^2 \cdot BD^2 = 4(\triangle BCD)^2$.

"Hence the proposition is true."

(*To be continued.*)

METHOD OF JOINTING AND LAYING GLASS TUBES.

Sir,—The following account of certain methods, proposed by me for jointing and laying glass tubes, which was written for a different object some time ago, may yet be of interest in the pages of your magazine.

My methods of jointing glass pipes are twofold; and, stated generally, consist either in the application of the electrotype process, to form a metallic joint, in whatever way or form, so as to close and join the ends of two contiguous pipes into a continuous tube; or, secondly, in the application of the process of tucking or constricting a flexible metallic collar round the contiguous ends of the pipes of glass, placed *in situ*, which process has been already used for closing metallic capsules over the corked mouths of certain bottles. Both processes may be varied much in detail; but the following are the details of practice which I would advise for adoption under each of the two heads of my invention:

First, *for closing the joints of glass pipes by the electrotype process*, the ends of the glass pipes are to be formed with a collar slightly projecting outwards, which is to be ground, or otherwise made flat and truly square to the axis of the tube. In laying the lengths of pipe together, these collars may be either doubly

Digitized by Google

abutted dry, or a little resinous, soft cement, or marine glue, or other fit, but not too hard cement, may be interposed; or a flange or washer of vulcanized India rubber, gutta percha, or cork, felt, or other fit material, may be interposed. A longitudinal section of the joint without flange is shown in fig. 1, and with cork or India-rubber flange in fig. 2.

Fig. 1.

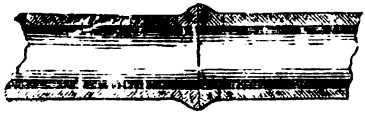
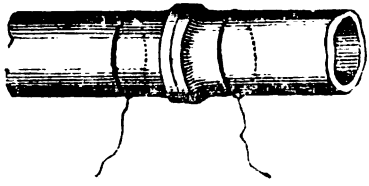


Fig. 2.

Being so placed previously, the end of each pipe is to be brushed over with turpentine, or other fit varnish, for about an inch in width round the collar, and dusted over with fine plumbago, or coal gas retort carbon, or bronze powder, or gilded with Dutch gold, or *metallized* on the surface in any other way. The metallized surface is then to be put in connection with the poles of a constant battery, by wires affixed in any convenient way. I prefer to twist a common copper bell wire round each length of pipe, close to the edge of the metallized surface, *remote* from the joint, for this purpose, as shown in fig. 3.

Fig. 3.



The joint, and a few inches of the pipes at either side of it, are now to be immersed in a solution of copper, or of any other suitable metal capable of being electrotyped, and metallic copper or other metal precipitated in a malleable closely-fitting ring round the junction, by which means the joint is finally and effectually closed. A convenient mode of immersing horizontal or vertical pipes in the metallic solution, is to place them in a hard wood box, lined with wax or marine glue, and parted in half, to permit the pipe to pass through—the joint of the box and round the pipe being made staunch with soft resinous cement, clay, or other such fit substance. Fig. 4 represents a vertical, and fig. 5 a horizontal pipe thus immersed.

Fig. 4.

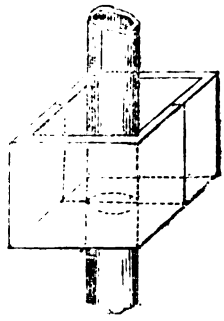
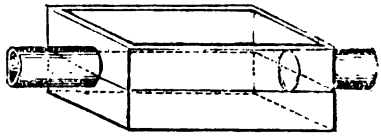


Fig. 5.



Curved pipes may *dip* into any fit sized vessel.

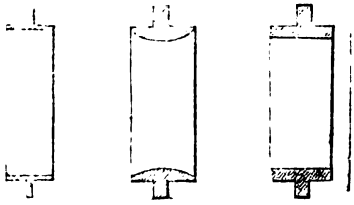
If corrosive vapours or fluids are to pass through the pipes, a thin film of gold, or other noble metal, or of lead, in case of sulphuric acid, may be first deposited just at the lips of the joint, to protect the copper from injury; or this may be effected by the nature of the cement between the lips or collars of the joint, which may be hard and incorrodible. The cork or other compressible flange between the lips of the joint, is to be used when change of form in the line of pipes, or expansion and contraction, are to be provided against. It seems unnecessary to enter more minutely into the details of the process of depositing the electrotype metallic collar round each joint, as this is now well understood by all competent persons. The junction of the metal, when copper is used, with the glass

Digitized by Google

is so accurate, and the metal so tough, that a small thickness (about one-twentieth of an inch) is sufficient to make the joint perfectly staunch under a considerable pressure, and even air-tight; which latter may be further insured by brushing over the edges of the metallic collar, when washed clean and dried, with any quick drying varnish.

If difficulties exist in forming the end collars upon the glass pipes of large diameter, they may be dispensed with, using the pipes with plain ends cut off square, and a loose ferule of metal (as fig. 6), pottery, or glass (fig. 7), or wholly of vulcanized India-rubber (fig. 8), inserted between: the transverse section of the ferule being as shown in these figures,

Fig. 6. Fig. 7. Fig. 8.



and the copper or other metallic ring being then electrotyped over this and round the ends of the adjacent pipes, as before described. Fig. 9 shows a joint so made in section.

Fig. 9.

In fact, very many modifications of jointing in this manner may be proposed and contrived, and the collars may be so made to insert between, as to allow branch pipes or off-takes to be attached to a line of glass pipes, or by boring a hole in one side of a glass pipe, and inserting or meeting it with the extremity of another (a branch pipe). The whole may be jointed, or, as it were, *soldered cold*, together, by the same process of electrotyping. Thus, fig. 10 shows a branch with vulcanized caoutchouc cotton, and fig. 11 a branch electrotyped without any cotton.

Fig. 10.

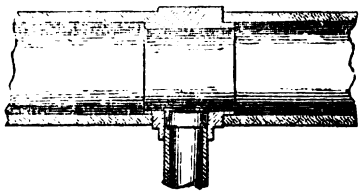
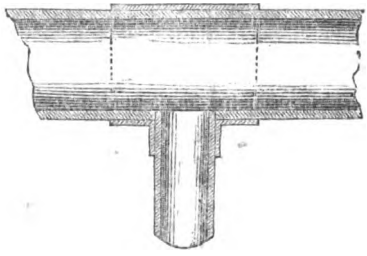


Fig. 11.



The *second* method of jointing glass pipes, *by a flexible metallic collar constricted* upon the pipes, is susceptible also of several modifications. The method I prefer is the following:

The glass pipes being prepared with collars as before described, and laid together, either with or without cement or compressible flanges between, a number of short cylinders of lead, block-tin, pewter, or other soft and flexible metal, are to be prepared. The length of these cylinders may be about $\frac{2}{3}$ the diameter of the pipe outside, the internal diameter being such as will just pass over the outside of the lips or collars at the ends of the pipe. The thickness of these cylinders will vary with the diameter of glass pipe, but should never exceed $\frac{1}{10}$ of an inch, or so, when slipped over the pipes *in situ*. The cylinder will be as in fig. 12.

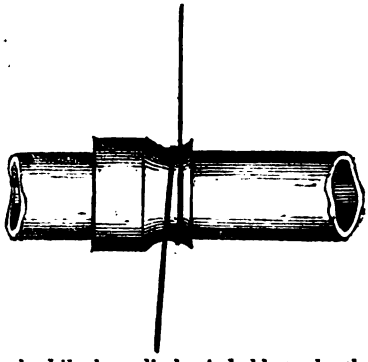
Fig. 12.

The inside of the cylinders may be coated with any suitable sort of cement that will adhere to it and to glass. A greased cord, of suitable thickness, is now to be passed round the cylinder, first at one side and then at the other of

Digitized by Google

the junction or lips, as shown in fig. 13;

Fig. 13.



and *while* the cylinder is held steady, the cord is to be drawn tight, and pulled rapidly back and forwards by the ends, so as to cause it to revolve back and forwards round the cylinder, by which means it will rapidly be *tucked in* or *constricted* round the glass pipe; and the same operation being now repeated at the other side of the joint lips, the flexible metallic cylinder will have completely moulded and applied itself to the outer surface of the joint, and made the same staunch for any moderate pressure from within.

The cord is best used attached to an elastic wood bow, like a large *drill bow*.

The cylinders of flexible metal must have no solder joints, but must be made out of one piece, either *drawn* or *struck* up, in the same way as Rand's patent collapsible paint-vessels are made. When this method of jointing is used, and much pressure is to be internally sustained, a copper or other wire may be bound round each end of the *constricted* and finished cylinder, so as to aid its resisting power.

This is the cheap mode I would advise for laying glass pipes, under moderate pressure, under ground. Marine glue seems an excellent cement to line the cylinders with for this purpose before constriction. During the process of constriction the ends of the adjoining pipes had best be steadied by the insertion of a loosely-fitting plug of soft pine or other wood, to be pulled along from joint to joint, as the line of pipes is laid.

Branches may be taken off at joints made in this way by forming a lateral opening and short cylinder upon the flexible joint cylinder, and closing it over the branch pipe, also provided with an end lip or collar, as shown in fig. 14.

Fig. 14.

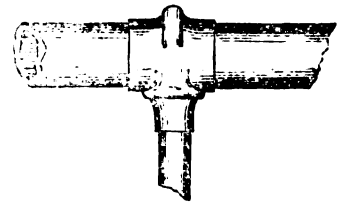
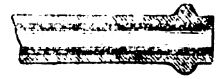


Fig. 15 represents the lip for branch pipe.

Fig. 15.



A method is successfully adopted in France of carrying underground glass pipes, free from danger of breakage by unequal external pressure, viz. by imbedding them in a mass of hard tempered mud or clay, prepared by a cylindrical mould to receive the lower semicircumference of the line of pipes, over which the covering of tempered clay is afterwards filled to the depth of 10 or 12 inches for large pipes.

BALANCED BRACKET GIRDER FOR BRIDGES, VIADUCTS, ETC. JAMES DREDGE, OF BATH, CIVIL ENGINEER, INVENTOR AND PROPRIETOR.

[Registered under the Act for the Protection of Articles of Utility.]

Fig. 1.

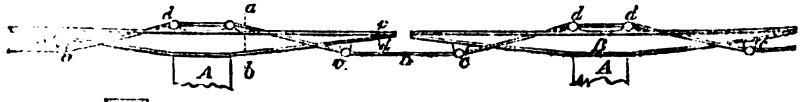


Fig. 3.

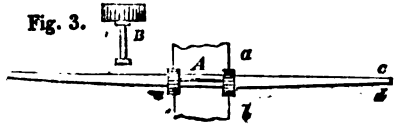


Fig. 2.

Fig. 4.

Digitized by Google

Fig. 1 is an elevation of this girder; fig. 2, a plan; fig. 3, transverse section, on the line *a b* of figs. 1 and 2; and fig. 4 is a transverse section on the line *c d*.

A A are the abutments upon which the girders rest. B B are the cast girders tapering from the abutments A A, to the extremity. These girders are flanged at top and bottom, and the flanges are also made to taper, as represented by B B, in fig. 2; *c* is an ear cast on the girder B to serve as an attachment for the truss rods D D. These truss rods are employed in the usual manner, that is, the diagonal bars *d c* are bolted to ears *d* at the upper edge of the girder, whilst at the lower end they are fastened to the ear *c*.

SMOKING PIPES.

Sir,—Having noticed in your very excellent work an improvement in smoking pipes, I beg leave to suggest an improvement in pipe tubes of a similar construction, but which is applicable to either a Dutch, China, or Meerchaum bowl. The greatest objection I see to "J. M.'s" invention is, that the cylinder he inserts will be very liable to get burnt and blocked up with the tobacco. Besides, he would require to have pipes made expressly for that cylinder; whereas my tube will suit any pipe. The annexed figures show a mode of construction whereby the longest passage may be procured from the pipe head to the mouth, which is the most desirable object in a tube. A represents the outer case which may be made of zinc, and neatly japanned, *c* an inner cylinder with a spiral twist round, as represented by D; this tube should be made of hard wood, and the twist D should be made of a narrow slip of hard leather, which would cause it to fit the tube A tight. B B are the holes for the smoke to pass through; E is the cork at the end for fitting the pipe tight, as usual in all tubes. F is the mouth piece; G is a small metallic tube (or glass) fitted and fixed into the end of the mouth piece F. These tubes may be made of any length to suit the taste of the smoker.

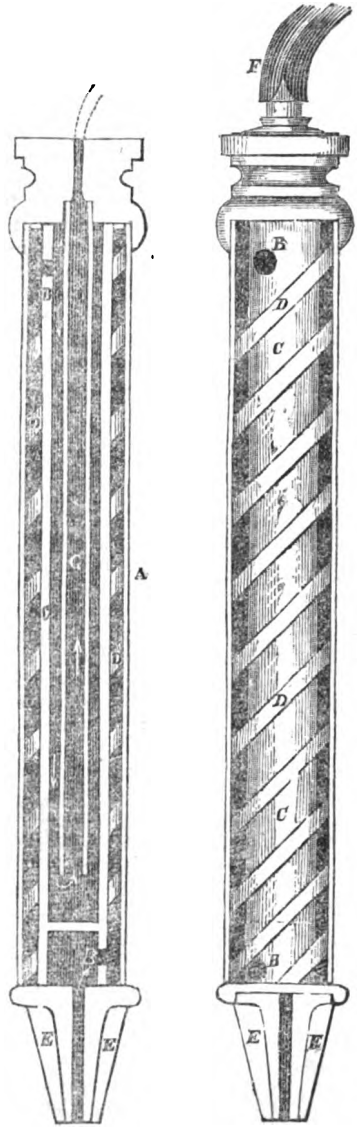
I remain, Sir, a constant reader,

M. W. Lyths.

Tobacconist.

Hull.

P. S. One I have now in use of this construction answers admirably, and decidedly improves the flavour of the smoke.



YACHT SAILING.

Sir,—In offering a few remarks upon the sails and sailing of yachts, I wish it

Digitized by Google

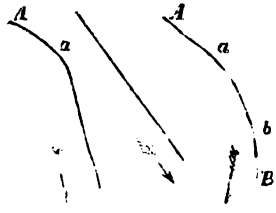
to be understood that they are brought forward, not as professing to contain original ideas or new inventions, but as the ascertained results of experience. Most of the following notions may have occurred severally to many of your readers, and it is with the desire of extracting from *them* more enlarged discussion on such points, that I bring them briefly under their notice.

I shall not offer any excuse for the free use of technical terms, because it is plain that those who are ignorant of nautical matters would find no interest in the subject, however more intelligibly expressed.

We may in considering the sails of the cutter-rig, divide them into those before, and those behind, the mast.

I. The jib and foresail. The jib is generally regarded as a lifting sail, and is supposed to be superior to the foresail in that important quality. But if both sails be sheeted home, and be considered as plane surfaces, it is evident that a normal to the jib makes a less angle with the horizon than that to the foresail. Nor will either jib or foresail be a lifting sail, when by heeling over to a breeze the normal becomes horizontal. Compared however with other fore and aft sails, a cutter's mainsail must always be a depressing sail, and could not be made to lift unless the peak were restrained by vaugs. It is a feeling almost natural to approve a gentle swell in a sail, but I think that a moment's consideration will convince us that the slight advantage arising from the greater resistance to a concave surface than to a plane is overrated, and indeed is outweighed by the concurrent drawbacks.

Fig. 1. Fig. 2. Fig. 3.



1st. If the form of a horizontal section of the jib be as in fig. 1, and if the part A *a* near the tack really holds wind, it is evident that the whole sail could be set with advantage if its horizontal section were a tangent to A *a* at A, as in fig. 2.

2nd. If fig. 3 be the horizontal section, and the proposition be allowed that the normal resolved force is the only effective one when wind acts upon canvas, it must follow that the part of the sail B *b* is actually opposing the motion of the vessel.

3rd. Although the motion of the wind parallel to the surface of a sail does not affect it, still the current thus deflected will most certainly act on any surface upon which it is afterwards thrown. Hence, if the draught thus produced falls on the lee side of the foresail, it will be seen, that moving in the directions of the arrows in the three cases respectively, it will be more prejudicial as in figs. 1 and 3 than as in fig. 2. Due regard is not paid to the effects of this powerful draught parallel to the surface of the jib; for we find it in general fashion to make the leack of the jib overlap the forestay sometimes by 6 feet. The upholders of this system assert, that by having a shorter foot to the jib we leave a large interval without canvas, and that this new form does not cause the foresail to shake. I would answer, that a considerable space is required to permit the escape of the wind after expending its effect on the jib and *having its direction changed;* and that if the foresail did *not* stand well under this usage, there would indeed be no room to doubt its being indefensible. This is a very important and interesting point, and is much canvassed among sailors. May I hope that additional light will be thrown upon it by some of your nautical correspondents. When a cutter can be relied upon as lively and sure in stays, I should always prefer to back the *jib and not the foresail*, and I know many sailors who never use the foresail in putting about. Upon this subject it must be remembered that the jib is less sensitive than the foresail, but has far more leverage and gives *very little stern way* when put back. In working to windward through a narrow channel or a river, this last-mentioned quality will be appreciated; but these observations are intended to apply only to cutters which can be trusted to go about all standing, and which have never known what it is to be *in irons*. Yours, &c.

JOHN MACGREGOR.

Digitized by Google

Sir,—I am not aware that the following properties of the number 123456789 have been ever remarked before—if they have, my letter must be regarded as another instance of a "resuscitated invention."

If 123456789 be multiplied by any number under 27 that is not a multiple of 3, the product will consist of the same series of figures 1, 2, 3, 4, 5, 6, 7, 8, 9, only arrranged in different order; and when the product consists of more than nine places of figures, the additional digit is either a 9 or 0. This will be evident on examining the following table of the products of 123456789 with the different numbers:

1	123456789	14	1728395046
2	246913578	16	1975308624
4	493827156	17	2098765413
5	617283945	19	2345678991
7	864197523	20	2469135780
8	987654312	22	2716049358
10	1234567890	23	2839506147
11	1358024679	25	3086419725
13	1604938257	26	3209876514

When it is multiplied by a multiple of 3, the product with the multiplier added to it will consist of a repetition of similar multiples of 37, terminating with a cipher.

For instance,

	123456789
Multiplied by $3 \times 17 =$	51
	123456789
	617283945
	6296296239
Add the multiplier	51
	629,629,629,0

629 being 37×17.

When, however, the multiplier exceeds 81 (27×3), the corresponding multiple of 37 will consist of more than three places, and the last figures of one will be found blended with the first of the next.

For instance,

	123456789
Multiply by $3 \times 49 =$	147
	864197523
	493827156
	123456789
	18148147983
Add the multiplier	147
	18148148130

Now $37 \times 49 = 1813$.

Therefore

1813
1813
18130

18148148130

This property, like that of the decimal expression for $\frac{1}{7}$, mentioned at p. 512 by your correspondent "J.," might be found of advantage to schoolmasters.

There is another fact relating to this same number 123456789 already well known; viz., that if the order of the digits be reversed, and the number itself be substracted from the reversed number, the remainder still consists of the same figures, only in different order. Thus,

987654321
123456789

864197532

I will add a few words on a property of pounds and shillings, and shillings and pence—not the invariable property they possess of making themselves scarce, but the following:—In any sum of pounds and shillings, if the number of pounds with the number of shillings added to it, be divisible by 19, the sum is a multiple of 19 shillings.

Take for instance £50, 7s.:—

Here, $50 + 7 = 57 = 19 \times 3$.

And £50 − 7s. = 1007s. $= 19 \times 53$.

In any sum of shillings and pence, if the number of shillings together with the number of pence be divisible by 11, the sum is a multiple of 11 pence.

Take for example 31s., 2d.:—

Here $31 + 2 = 33 = 11 \times 3$.

And 31s. − 2d. = 374d. $= 11 \times 34$.

These two last can be easily explained on the same principle as the well-known property of the number 9. But the fact that 123456789, multiplied by a non-

Digitized by Google

multiple of 3, should reproduce the same figures, is, I must confess, to me unaccountable.

I am, Sir, yours, &c.,
J. E.

June 23, 1847.

THE ARCHIMEDEAN BALLOON.

Sir,—As the objections made by Mr. M'Gregor to my Archimedean balloon, although true in principle, seem hardly applicable to that machine, I venture to intrude once more upon your valuable pages with a few remarks, which I shall make as brief as possible.

Mr. M'Gregor complains of the unscientific manner in which a motive power, proper for aerial navigation, is generally proposed to be applied; and states that "the propelling machine is suspended, and its direction of force consequently some 50 feet distant from that of the resistance offered by the atmosphere." Correctly speaking, my propelling apparatus is not suspended from the balloon, but the latter is firmly attached to the machine by posts and ropes; the gas is applied merely to diminish the weight, the paddles are to lift the machine in the required direction, and are, in fact, the true suspenders. The elevation of my machine was drawn on a scale of 20 feet to an inch, and the section on twice that scale; and from considering the atmospheric resistance exerted below the paddle-wheel shafts, as well as that exerted above them, it will be seen that the central point of atmospheric resistance, so far from being 50 feet above the line of propulsion, is not so much as 10 feet. Whether or not the cylinder would require enlarging to so great an extent as to bring the centre of horizontal resistance to so great a height, remains to be proved. As it is, the atmospheric resistance preponderating above the line of propulsion will give the whole machine a tendency to rise up in front, which could at once be checked by causing the hindmost paddle-wheels to propel the machine more vertically than the foremost ones, which could easily be done by shifting the guide-wheels. This would certainly involve some waste of power, and the necessity for it might be obviated by constructing the machine with a greater depth below the line of propulsion.

But even this latter remedy Mr. M'Gregor seems to think has its evils; and states, that if the gas-bags beneath the machine were to equalise the horizontal resistance, and be at the same time buoyant, they would throw the whole fabric on its side. Now, seeing that in a machine so constructed, the central line of atmospheric resistance would coincide with the line of propulsion, and that the centre of gravity would be, as in the present machine, below both these lines, I do not see how the centre of gravity is to be brought up level with the line of propulsion, so long as the machine is supported in the air by the action of its paddles. For as the whole fabric is kept from falling by a power which takes effect at the four points where the paddle-wheel shafts enter the hull, and as these points are above the centre of gravity, I see nothing to disturb the equilibrium, so long as the atmospheric resistance is equalised. It must be particularly borne in mind, that I do not mean the machine to be lifted by the gas, but by the paddles; the gas is applied in order that the weight may be reduced sufficiently for the paddles to cope with it.

Mr. M'Gregor states, that the gas-bags under the machine would not support themselves. According to the scale it will be found, that making no allowances for bulging, they contain 10,614 cubic feet under a superficies of 4,196 square feet. Taking the buoyancy of hydrogen gas at 1oz. per cubic foot, we here have a buoyancy of 663lb. Allowing the casing to weigh 3oz. per square yard, which is strong enough for a large balloon, the casing would weigh 87lb., leaving, therefore, an effective buoyancy of 576lb. The weight of the casing might be diminished by the weight of nearly 400 square feet, by having the three bags made into one. In calculating the weight of the casing, the frame-work must not be reckoned, as that would be required if there were no gas-bags.

Taking my machine as it stands represented in the elevation, the main objection to it appears to be its want of buoyancy. This may be remedied in some degree by increasing the size of the cylinder and gas-bags longitudinally; but if the diameter of the cylinder be enlarged, the depth of the gas-bags must be increased likewise; and as there is a limit to the latter, so there is to the former. When I planned my machine, I was in hopes that the diameter of the cylinder might be increased considerably without endangering the equilibrium of the fabric; but as the case appears to be otherwise, I am now endeavouring to devise a modification of my machine, which shall enable it to carry a large quantity of gas without incurring any risk of losing its equilibrium, and have considerable hopes of success.

I remain, Sir, yours very respectfully,
J. PITTER.

Hastings, July 7, 1847.

Digitized by Google

EFFECT OF PREMIUMS.—A HINT FROM BROTHER JONATHAN TO THE LONDON SOCIETY OF ARTS.

We have determined not to particularize any articles included in the exhibition (Fair of the American Institute), at this time, that we may avoid all occasion for harm or bad feeling on the assumed ground of partiality or mercenary motives. All has been done that was promised by the Institute, and many very satisfactory extra exhibitions have been given. The whole closed, with a practice "more honoured in the breach than the observance," and we would like to convince the Institute of the fact; we refer to the award of *premiums*. This is the only really bad part of the matter; the giving of premiums tends to make the jealous more jealous, and the vain more vain. None like to see their own works surpassed, and particularly do they dislike to have them adjudged to be so, and by, perhaps, sometimes prejudiced or incompetent persons. These are not groundless objections. It has been a matter of regret that so great a decrease of the number of mechanical inventions and devices has been noticed at each succeeding exhibition. The *premiums* are the cause. There is no doubt of this. The *premium* is the general cry.—It was awarded to one, and ought to have been to another. And it has been said, with how much truth we cannot aver, that if every exhibitor was awarded a gold medal there would be some who would want more.

Let the American Institute continue its fairs, but abandon its premiums; and if they want to make a noble disposition of some portion of the vast receipts, let them establish a fund for the aid of poor inventors, who cannot obtain the means of bringing forth to the world their valuable inventions, under such a board of direction as is in their power to appoint. Let them abandon their premiums, and announce the fact to the world, and append the above to such announcement, and our word for it, there would be such a display of mechanical ingenuity and inventive skill as has not yet been seen; and without the premiums the whole would come before the world upon equal terms, and equal rights, and the great inducement to exhibit articles would not be a mere toy; but the more useful object of the display of each one's manufacture, to the great national gathering of the people at the fair of the American Institute, each for the good he would gain to himself, by a display of his articles to the mass of society, where he could fairly explain, and unbiassed, leave the public, the examiner, to judge of the merit or demerit in the premises. Thus right would ever triumph over might, and the institution gain honour, as it dispenses its usefulness to the world.—*The Eureka, or Journal of the (U. S.) National Association of Inventors.*

POWER OBTAINABLE FROM THE DECOMPOSITION OF WATER—INQUIRY.

Sir,—Allow me to ask, through the medium of your excellent Magazine, the opinion of any scientific man on the following question:—

Would the gases evolved by the decomposition of water, at the poles of a galvanic battery, continue to be so evolved if enclosed in an air-tight vessel, fitted with an escape-valve capable of being loaded with any required pressure, say 40, 50, or 60 lbs. per inch, or even higher, should the vessel be strong enough to stand it?

If such should be the case, and provided the required pressure could be maintained, these gases might, I should think, be made available in driving an engine similar in construction to the non-condensing steam-engine.

The quantity of gases given off would, no doubt, be in proportion to the surface of metal exposed to the water to be decomposed, and to the power of the battery acting upon that metal, as in the case of a steam-engine boiler, whose power is in proportion to the surface exposed to the action of the fire, and to the quantity of coals consumed.

The expense of maintaining the proposed power will, of course, be in proportion to the quantity of battery materials consumed, and can only be determined by actual experiment, as can only the area of generating surface. The idea of using gases thus obtained, as a source of power, occurred to me two or three years since, and has lately been revived by reading the accounts of the compressed air locomotive.

Without trespassing more on your valuable space, I beg to subscribe myself,

Your obedient servant,

A SUBSCRIBER.

Plymouth, July 6, 1847.

IMPROVED SPARK ARRESTER.

Mr. James Milholland, Superintendant of road and machinery on the Baltimore and Susquehannah Railroad, has made, it is said, a valuable improvement, which effectually arrests the escape of sparks and cinders, while its construction permits the smoke readily to pass out of the pipe without obstruction. This improvement cannot but prove of great utility in removing one of the greatest present annoyances to the travelling public, and which will be appre-

Digitized by Google

ciated by every one who has suffered from this cause. The Baltimore *Sun* in noticing this improvement remarks:—

In 1833, shortly before that road was completed, Mr. R. L. Stephens, the President of the Baltimore and Susquehannah Railroad Company, suggested the use of a bonnet of wire gauze to the smoke pipe, which was tried in several forms, until at last it assumed the shape of the frustrum of an inverted cone, surrounding the pipe for some distance below the top and covered by a hemispherical cap of the same material. This arrangement was found to arrest the sparks which fell into the conical pocket formed around the pipe by the lower part of the wire gauze; but here another difficulty arose: the accumulated sparks were fanned by the rush of air produced by the rapid motion of the engine, into a fierce fire, which soon destroyed the wire netting, permitting them to escape as before. The most obvious remedy for this was to exclude the air, which was done by enclosing the lower part of the cone with sheet iron, which answered very well until the accumulation of sparks filled the iron, when they were again ignited by the rush of air. Another and another portion of the cone was covered, until it was found necessary to have the whole of the inverted cone made of sheet iron, with a door in the lower part, to extract the extinguished sparks from time to time during stoppages. In order to enlarge this receptacle for the sparks, the cone was extended the whole of the way down the pipe, which arrangement is at present in use in various modifications on the railroads of the United States. By one of those singular coincidences which often occur in the discovery of useful improvements, the same results were obtained by Mr. H. C. Wyatt, of Weldon, North Carolina, in a course of humbler experiments. He adapted the same arrangement to the bowl of a tobacco pipe, and by blowing into the stem of the pipe, the smoke was driven through a perforated tin cover and the sparks arrested in the same manner precisely. Mr. Wyatt obtained a patent for his invention; for the infringement of which, his assignee lately recovered a verdict in the United States' Circuit court.

Mr. Milholland's improvement consists of a globe of perforated sheet iron covering the top of the smoke pipe, surrounded at a short distance by a shield of close sheet iron to exclude the air, with an opening at the top sufficient to permit the escape of the smoke. From the bottom of the perforated globe a pipe conducts the sparks into an air-tight iron box, sufficient to contain all the sparks arrested during the usual trip of the engine. This box Mr. Milholland calls by the expressive term of the sub-treasury. The large and powerful locomotive William H. Watson lately built under the superintendence of Mr. Milholland, at the Boulton depôt, is fitted up with this improved spark arrester, and we are informed it fully answers his expectations. —*The Eureka.*

THE ROSSE TELESCOPE.

Professor Mitchell, of New York, in a recent lecture on astronomy, gave the following vivid picture of the wonderful discoveries achieved by the telescope of Lord Rosse:

"Let me now consider the instrument constructed by that distinguished nobleman Lord Rosse. Distrusting the power of the refracting telescope, he determined to give his energies to the construction of a reflecting telescope that would enable him to make greater discoveries than any hitherto made. I need not detail the construction of this mighty instrument. Instead of limiting his *speculum* to four feet, as Herschel had done, he gave it *six*, with a focal distance of *sixty feet*. The capacity of this instrument is wonderful. Such is its power, that if a star of the first magnitude were removed to such a distance that its light would be sixty thousand years in travelling to our earth, this telescope would reveal it; were it removed so far that its light would be three millions of years in reaching us, this telescope would, nevertheless, show it to the human eye. Is it to be wondered at, then, that with such an instrument grand discoveries should be made? It has been pointed to the heavens, and although in the beginning only of its career, it has already accomplished mighty things. There are nebulous spots in the heavens which have baffled all the instruments hitherto constructed: but this telescope resolves their true character completely. Among the wonderful objects which have been subject to its scrutiny, is the nebula in the constellation Orion. I have had an opportunity to examine it. It is one of the most curious objects in the whole heavens. It is not round, and it throws off furious lights. From the time of Herschel it has been subjected to the examination of the most powerful instruments, but it grew more and more mysterious and diverse in its character.

"When Lord Rosse's great telescope was directed to its examination, it for a long time resisted its power. He found it required patient examination—night after night, and month after month. At length a pure atmosphere gave him the resolution of

Digitized by Google

its constitution, and the stars of which it is composed burst upon the sight of man for the first time."

COST OF AMERICAN PATENTS TO BRITISH SUBJECTS.

We are delighted to observe in the Report for 1847 of the American Commissioner of Patents (just issued) the following enlightened sentiments on this subject: "By the existing law, a subject of Great Britain is required to pay into the treasury a duty of 500 dollars before his application can be examined. The citizens and subjects of all other foreign countries are each required to pay into the treasury a duty of 300 dollars on their respective applications. These duties were designed to bear some proportion to the duties acquired of American citizens making applications for patents in other countries, and on that ground may, perhaps, be justified and defended. The effect of this provision is unquestionably to prevent the introduction into this country of many useful and valuable discoveries, which would otherwise be patented and introduced. Similar high duties have the effect to exclude American inventions from other countries. Thus, all countries are injured by this system of taxing genius for the exertion of its powers, in order to obtain comparatively a very small and trifling amount of revenue.

"It affords no protection to the American inventor to keep out the discoveries of his foreign emulator (not rival) in the arts, by taxing the emanations of his genius with high duties, while the country would derive much benefit from their introduction.

"Therefore, it is respectfully submitted whether it would not be expedient were Congress to provide contingently for the reduction of the duties required on application for patents by the citizens or subjects of foreign governments to thirty dollars, whenever it shall appear that corresponding reductions have been made by those governments of the duties required of American citizens. I have reason to believe that the proposition would be received with favour by some, if not all, of the European governments."

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal* for May.]

IMPROVEMENT IN THE FILTERING-COCK. *Thomas F. Wenman.*

The valve of this cock is a hollow cone divided into two chambers by a filtering partition, so that the liquid in passing through shall be filtered.

Claim.—What I claim as my invention, is the application of the filter within the inner cone of the cock, by means of a groove made in the inner cone; also, on the bottom plate placing the two perforated plates, with the filtering substance between them, so that all the water, or other liquid fluid, has to pass through the plates and filtering substance above named, substantially in the manner and for the purpose described."

IMPROVEMENT IN THE METHOD OF CONSTRUCTING TRUNKS. *James Hibson.*

The patentee says,—"My improvement is confined to the skeleton, or frame-work, of travelling and other trunks, and to the mode of connecting thereto the exterior covering. Instead of constructing the ribs (which constitute the skeleton of such trunks,) of wood or metal, I use strips of whalebone, which, by its elasticity, preserves the original shape of a trunk after the latter has been subjected to wet or accidental pressure; these strips, when bent to the required form, are secured to the iron lips of the trunk by having their ends inserted into sockets formed of sheet metal, and riveted to the lips. The lips are united at one side, by metallic or other hinges, in the usual manner. To connect the outer, or leather, covering to the skeleton, I use small clamps, made of thin sheet metal."

PROCESS OF PURIFYING OR CLEANING WHALE OIL. *Patrick Fitzsimmons.*

For the purpose of precipitating the gelatine and albumen, finely pulverized alum is mixed with the oil. The proportion of alum for a hundred gallons of oil is from fifteen to twenty-five pounds, according to the quality of the oil.

IMPROVEMENT IN PRINTING PRESSES. *Alva B. Taylor.*

To avoid the shock and jar at the end of each reciprocating motion of the carriage of the Napier press, particularly when it is attempted to operate the press with considerable velocity, air cushions or springs are used, and made by having a piston or pistons attached to the ends of the carriage, so as to compress air in cylinders attached to the frame. These pistons either enter short cylinders at the end of the motions of the carriage, or the cylinders have apertures near the end, so that the pistons are only resisted by the compression of the air towards the end of the motions of the carriage.

IMPROVEMENT IN THE SELF-ACTING REGISTER FOR STOVES. *Washburn Race.*

An expansion rod is connected at its lower end by a knife edge with a lever which, is in turn connected with the register; so that as the rod contracts by the reduction of temperature the register is opened, and vice versâ.

Digitized by Google

IMPROVEMENT IN RAILROAD WHEELS. *Thomas Glasco.*

This is for a mode of fastening the treads or tyres of railroad wheels to the main rim, or "centre" as it is termed in the specification before us. The outer periphery of the "centre," is made conical to fit the correspondingly formed inner periphery of the tread, and the outer periphery of the "centre" or inner rim is grooved to receive a ring cut in three parts, so that when the outer rim or tread is slipped on, by means of radial screws, the segments of the ring can be forced into a groove in the inner periphery of the outer rim; one face of the segment ring being bevelled so that, when forced out, they (the segments) shall act as wedges to force the outer on to the inner rim.

MAGNETIC TELEGRAPH. *Samuel F. B. Morse.*

Claim. "What I do claim as my invention is the receiving magnet, or a magnet having a similar character, that sustains such a relation to the register magnet, or other magnetic contrivances for registering, and the length of current or telegraphic line, as will enable me to accomplish, with the aid of a main galvanic battery and the intervention of a local battery, such motion or power for registering as could not be obtained otherwise without the use of a much larger galvanic battery.

"I claim as my invention the use of a local battery and magnet, in combination with a battery and magnet connected with the line or lines of conductors, for the purpose above specified.

"I also claim the combination of the apparatus connected with the clockwork for setting off the paper, and stopping it with the pen lever.

"I also claim the combination of the points affixed to the pen lever with the grooved roller for marking on paper, as above described."

EXTENSION FRAME FOR BEDSTEADS. *C. S. Debow.*

The patentee says:—"The distinguishing character of my invention is the employment of the well known series of cross levers familiarly known as 'lazy tongs,' placed in a horizontal position, but turned edgeways for supporting, while they can be contracted or extended at pleasure; any number of these being placed parallel, and at a sufficient distance apart, for the purpose intended, and connected by cross bars for purposes above named; when extended forming a bedstead or other supporting frame; and when contracted occupying the smallest possible space."

IMPROVEMENTS IN THE MAGNETIC LETTER PRINTING TELEGRAPH. *Royal E. House.*

Claim.—"What I claim as my invention, and not previously known in the above described magnetic letter telegraph, is—

"*First.* The manner in which I arrange and combine the finger keys, a key shaft, and a circuit wheel, respectively, for the purpose and substantially as herein described.

"*Second.* The combination of the escapement with the type wheel, by means of pins in the side of said type wheel corresponding in number with half the number of letters and other characters which the type wheel is constructed to form, and the above combination and arrangement of the escapement and type wheel in combination with magnets, as herein described, and for the purpose herein stated.

"*Third.* The combination of the type wheel with the lever, by means of pins fixed in the sides of said type wheel equal in number to the number of letters and other characters formed, (and by other characters I mean as well blank spot as the letters and dot,) for the purpose of regulating the motion of the shaft, to carry the paper cylinder to and from the type wheel, all as described in said specification.

"*Fourth.* The manner of combining the shaft with the lever, by means of the pin, and projections on said wheel.

"*Fifth.* The combination of the lever with the hydraulic regulator, to produce the effect herein pointed out, and in the manner herein described.

"*Sixth.* The manner of producing and regulating the several motions of the paper cylinder by the combined action of the several parts respectively, as herein described, viz.: The hydraulic regulator, the wheel, the lever, the type wheel, the eccentric shaft, and the rods connected therewith, the ratchets, or catches, and the posts as herein described. I also claim the manner of applying the plumbago to blacken the type, as herein described.

"*Seventh.* The combination of the composing apparatus with the magnet for the purpose specified."

IMPROVEMENT IN CURRYCOMBS. *William Wheeler.*

The patentee says,—"I construct my currycombs generally of three longitudinal bars of sheet metal, united by rivets to two transverse bars, one at each end, and one at the middle of the instrument; there being open spaces formed by the junction of these bars, or plates, through which a large portion of the dust, which would otherwise lodge in the comb, escapes in the act of using it.

Digitized by Google

"The three longitudinal bars are in a trough-like form, being bent twice at right angles, by which means they are rendered perfectly unyielding. The teeth are made along the edges of these trough-like pieces, and they are sometimes rounded off at their ends to remove their angular terminations; the bars constituting the comb being of one uniform length."

COMPOSITION OF MATTER TO BE USED AS A SUBSTITUTE FOR TYPE METAL, AND ON WHICH IMPRESSIONS CAN BE MADE WITH TYPES, &c. *Josiah Warren.*

As this invention gives promise of being very valuable, we insert the specification entire.

"Mould, or matrices, are made of a tough, strong clay, mixed with silex in impalpable powder in sufficient quantity to prevent cracking. These materials are made with water into a strong putty, and kneaded very thoroughly until it has acquired all the toughness that can thus be imparted to it.

"This mixture is now softened with water till it will spread easily and smoothly upon a metallic plate; the thickness of coat varying, according to the work to be done, from the thirtieth to the tenth of an inch.

"The plates, thus coated, are allowed to become about half dry, so that a type impressed into them will leave a smooth *fac simile* of itself.

"Into this coating forms are impressed, as hereafter described in stereotyping plates. These forms may either be an original design, or impressed by an original to obtain a copy. When the coating is required to continue moist a longer time than the above, a heavy coating, with additional silex, from a twelfth to an eighth of an inch thick, is first spread upon the plate, and immediately afterwards the coating first described is spread upon the under coating. It is well to spread, with a light brush, a little thin gum Arabic paste between the two coatings, but not indispensable.

"The above-described matrices are used for music, maps, and similar open work; but for fine, close, or shaded work, and for writing, the coating should be of very fine clay, without any admixture of silex, more than is chemically combined to form the clay. This clay should be of such a nature as will admit of its being spread in the form of a thin mortar, to the thickness of one-thirtieth of an inch, without showing any cracks in drying. Clay of this quality is found along the banks of the Ohio river, near Evansville, Indiana.

"When the coating is intended for a close *Italic* handwriting, it may be spread with a tool so constructed as to leave furrows in the surface at such suitable distances as the writer may desire to have his lines; when this becomes hard enough to cut without following the tool, it may be slightly brushed over with a little olive or linseed oil. The writing is done in the furrows with any suitable tool.

"To write a copper-plate, or running hand, or for close drawings, the following is a good process. Mix a small quantity of gum Arabic paste with the mortar made of the pure clay, as above described, enough to change the colour of the clay a shade darker when dry. Let this coating get quite dry, and brush it over slightly with oil. With another brush moisten each line or furrow before writing on it.

"The writing may be done in the ordinary manner, never allowing the tool used to go quite down to the foundation plate. The cast from this matrix will present a slightly uneven surface, which may be gently ground down with a hone or fine whetstone.

"The following process may be used as a substitute for the method above described:

"Spread a plate with pure clay, say one-thirtieth of an inch thick, or as thick as will dry without cracking; when dry, heat it sufficiently to melt wax. Then rub over the surface a little beeswax, stearine, or tallow, and allow the plate to cool. When cold, spread on another coating of pure clay in which a little olive or linseed oil is thoroughly mixed. This should be worked on as soon as it is sufficiently dry to allow the tool to work freely.

"A great variety of clouded, wavy, or smoky effects, either as parts of a picture, or as tinted grounds, are instantly produced in a matrix by wetting the surface to a creamy softness and applying a brush, or toothed tool, with such motion as may be adapted to the design. This may be termed the *Hylographic process.*

"Type composition, or *silicate of lac.*

"Take one pound of good shellac, say four ounces of good clean tar, melt together over a gentle fire, and then stir into this mixture two pounds of fine siliceous sand. When thoroughly mixed, turn out and flatten into thin sheets, say an eighth of an inch thick. When cold it may be broken up for use.

"Place the matrix over a very gentle heat, in order to expel all dampness; raise the heat a little short of the hissing, or boiling point, then lay over the matrix pieces of the silicate sufficient to cast a plate an eighth of an inch thick. Lay upon this a wooden block of the length and breadth required, and about three-fourths of an inch thick. When the silicate is sufficiently softened to take the impression, take the whole to the

Digitized by Google

press. Strips of wood, or other material, should be placed upon each end of the matrix plate, as guides or bearers, so that the cast shall be exactly type *height*. This being done, bring the press gently down upon it, until the bearers stop it. When cold, remove the cast from the matrix plate, and with a brush carefully wash the face of the cast without wetting the back of the block. The face of the cast, or type, may be polished with a hone or other suitable substance. It is now ready to take a proof, and, if perfect, is ready for the press. If not perfect, mark the imperfection on the proof-sheet, to be corrected by the following process of

"*Stereotyping.*—Take a metallic plate, previously spread with the coarse under coating, say four of fine sand to one of clay, covered with a coating somewhat finer, as first described; when this is so dry as to leave a clean impression from a type, it is ready for use. Next secure the imperfect cast of the type firmly in a square frame, or printers' *chase*, with guides or bearers, as before mentioned, to prevent too deep an impression.

"The plate, with the clay coatings, is now turned down upon the cast, and placed under the press. The pressure is gently withdrawn, and the imprinted matrix lifted carefully from the cast, or type. (The bearers should have springs, so constructed as to lift the matrix from the type on the withdrawal of the pressure.) This gives a new matrix, in which all the necessary corrections are made, and a new cast taken, as before.

"Stereotyping may be performed by the use of any of the matrices above described, using them when the moisture is sufficiently evaporated to leave a clean impression from a type, as before mentioned. Fine engravings, or any thing of that nature, may be more beautifully stereotyped by the use of a matrix of pure soft clay mortar, spread thinly upon a flat surface of dry clay. Press the engraving into it, and allow it to remain until the whole is sufficiently dried to lift the original from the matrix.

"Coats, or types, for printing *fac similes* of leaves, or other substances, the different parts of whose surface do not vary in height more than the twelfth of an inch, may be readily made by using those substances themselves to impress their form, either in the clay matrix or in a flat surface of the silicate previously prepared to be used as a type.

"The blanks between paragraphs of written or printed matter, whether in the original or in the stereotyped matrices, should be filled up with a mixture of about six parts of fine sand to one of clay, which should be applied about the thickness of cream. The margins may be filled with the same mixture, in the form of mortar, and may be applied with a knife or spatula."

NOTES AND NOTICES.

Improvement in the Electro-Magnetic Battery.—We are informed that Mr. L. B. Swan, of this city, has discovered a new solution, or exciting liquid, for the galvanic battery, which promises to be of great utility to telegraph companies, as it is a saving of *seventy-five per cent.* in the materials employed, besides a large amount of labour and attention. The improvement consists in furnishing an exciting liquid, which produces an electric and galvanic current of uniform power and intensity, without the rapid decomposition of the metals and acids, heretofore supposed unavoidable. The solution discovered by Mr. S. does not act chemically on the mercurial amalgam, and with such trifling action on the zinc as to be scarcely perceptible. Mr. Barnes, (the intelligent telegraph operator at this station,) informs us that he has used this solution for *forty-five days*, without alteration, no fresh amalgam or acids have been required (except to supply the ordinary evaporation), and without any perceptible destruction of mercury or zinc; during which time the battery has been in *constant and efficient action!*—*Rock. Adv.* (U. States).

Organ Piano.—The following communication from the *Eureka* of New York:—"I have a petition pending for a patent upon a new parlour instrument which I call an *Organ Piano*—as it possesses the qualities of both the Pipe Organ and Pianoforte—so nearly that a good performer can imitate either instrument so perfectly as to deceive an experienced ear. It is made in the form of a square horizontal pianoforte—though the form may be varied to taste. It is judged to possess at least three times the power of a pianoforte—and the *swell* is comparatively PERFECT; from the softest tones of the Æolian Harp to the body of a six stop Organ, and is effected with pedals and the fingers, like the pianoforte. It is well adapted to the slowest church, or the quickest waltz music, or *any* movement whatever. In compass 6 to 7 octaves. I fully *believe* it to be *more durable* than any keyed instrument of which I have any knowledge."

Malleable Glass—Something nearly as good.—Professor Schœnbein, who invented the Gun-cotton, is stated in the *Revue Scientifique et Industrielle* to have, to a certain point, discovered *Malleable Glass!* He renders *paper paste* (papier maché) transparent by causing it to undergo a certain metamorphosis which he calls *Catalytic*, for want of a more intelligible term. He makes of this new paper window-panes, vases, bottles, &c., perfectly impermeable to water—and which may be dropped on the ground without breaking—and are *perfectly transparent.*

Bronzed Cannon.—According to experiments made in Prussia, iron cannon bronzed, though one-third less in thickness than ordinary cannon, will bear a larger charge of powder.

LIST OF ENGLISH PATENTS GRANTED ON JULY 10, TO JULY 13, 1847.

Samuel Stokes, of Monkwell-street, carpenter, for an improved machine for tracing or engraving from solid bodies, or subjects in relief. Six months; July 10.

Robert William Sievier, of Henrietta-street, Cavendish-square, gent., for an improved material or materials for purifying or decolorizing bodies, which material may also be employed as manure and pigments, and for other like purposes. Six months; July 12.

William Edward Newton, of Chancery-lane, civil

Digitized by Google

engineer, for certain improvements in the manufacture of screws. (Being a communication.) Six months; July 12.

William Langley Beal, of Whitstable, Kent, smith, for improvements in the construction of anchors. Six months. July 13.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for certain improvements applicable to locomotive engines and carriages employed on railways. (Being a communication.) Six months. July 13.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
July 10	1125	Sydney Smith	Willenhall	Spindle for door lock.
,,	1127	Francis Henry	Willenhall	Bolt.
12	1128	Anthony Binns	Ocean-row, Stepney	Horizontal tidal shifting steps for piers.
,,	1129	Deane, Dray, & Deane,	Arthur-street East, London-bridge	Grain, spice, & seed-cleanser, sifter and polisher.
13	1130	Thomas Henry Masters,	York-street, St. James's-square, London	Tobacco-supplier.
,,	1131	Alexander Haig	Smith-street, Jubilee-place, Stepney	Portable forge.
14	1132	William Palmer	Sutton-street, Clerkenwell	Glass holder of a candle-lamp.
15	1133	Charles Gillett	Bristol	Universal cravat-fastener.

Advertisements.

TO MINE AND COLLIERY PROPRIETORS, SLATE QUARRY OWNERS, RAILWAY CONTRACTORS, IRONMONGERS, DEALERS IN GUNPOWDER, AND OTHERS.

MESSRS. JOHN HALL AND SON, THE PATENTEES AND SOLE MANUFACTURERS OF

SCHONBEIN'S PATENT GUN-COTTON,

Respectfully state, that they are now prepared to SUPPLY the PATENT GUN-COTTON (compressed for the convenience of carriage), in round and square paper cases, of 4 ozs. each, packed in boxes, containing 50 and 100 cases each, at the price of 3s. per lb., for ready money.

Also, in tubes or cartridges of... 1, 1¼, 1½, and 1¾ inch diameter;
Containing ..... 2, 4, 6, and 8 ounces each, at the
Additional charge of..... 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 3 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

Office, 23, Lombard-street, London.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are, that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

Spence on the Specification of a Patent.

This day is published in 8vo., price 7s. 6d., boards.

A TREATISE on the Principles relating to the Specification of a Patent for Invention; showing the standard by which the sufficiency of that instrument is to be tried.

By William Spence, Assoc. Inst. C. E., Patent Agent.

London: Stevens and Norton, 26, Bell-yard, Lincoln's-Inn, and 194, Fleet-street.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs T. Burnell and Co., 1, Great Winchester-street, London.

NOTICES TO CORRESPONDENTS.

A. H. in our next.

Mr. Sutton's communication has been received, and is under consideration.

Communications received from W. O.—M. M. P. Shuttle—E. S.—A Constant Reader.—J. M. B.

CONTENTS OF THIS NUMBER.

Bain's New System of Electro-telegraphic Communication.—The Specification, Verbatim, Continued—(*with engravings*) 49

Mr. De la Haye's Theory of Etherization..... 54

The Centurion Papers.—No. 1..... 55

Description of Different Methods of Jointing and Laying Glass Tubes—(*with engravings*)... 57

Dredge's Balanced Bracket Girder, for Bridges, Viaducts, &c..... 60

Smoking Pipes 61

Yacht Sailing. By John M'Gregor, Esq..... 61

Remarkable Properties of Numbers..... 63

The Archimedean Balloon — Mr. Pitter in Reply..... 64

Effect of Premiums—Hint from Brother Jonathan to the London Society of Arts 65

Power obtainable from the Decomposition of Water—Inquiry..... 65

Milholland's Spark Arrester 65

The Rosse Telescope..... 66

Cost of American Patents to British Subjects... 67

Recent American Patents.—Wenman's Filtering Cock—Hibson's Trunks—Fitzsimmon's Purification of Whale Oil—Taylor's Printing Press — Race's Stove Register — Glasco's Wheels—Professor Morse's Improvements in Electro Telegraphy—Debow's Bedstead—House's Magnetic Letter Printing Telegraph —Wheeler's Currycombs—Warren's Types... 67

Electro Magnetic Battery — Organ Piano—Transparent Papier Maché—Bronzed Cannon..... 70

Weekly List of New English Patents 70

Weekly List of Articles of Utility Registered. 71

Advertisements 71

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,

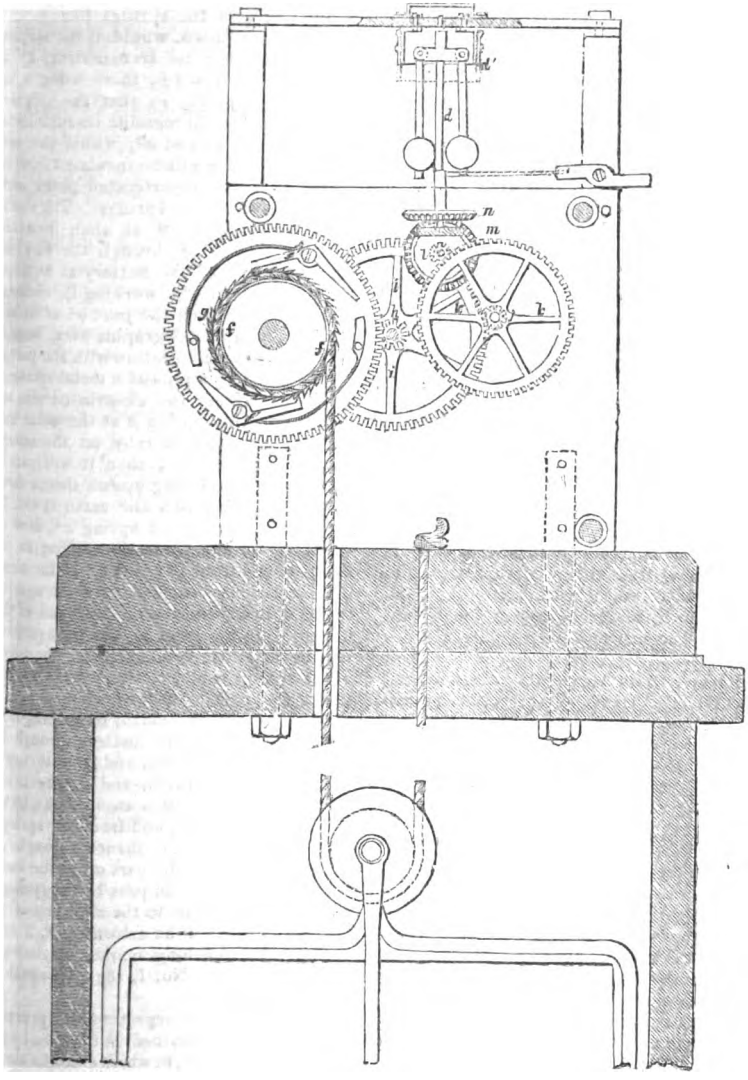
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1250.] SATURDAY, JULY 24. [Price 3d.

Edited by J. C. Robertson, 166 Fleet-street.

BAIN'S NEW SYSTEM OF ELECTRO-TELEGRAPHIC COMMUNICATION.

Fig. 11.*



Digitized by Google

MR. BAIN'S NEW SYSTEM OF ELECTRO-TELEGRAPHIC COMMUNICATION.

(Concluded from p. 54.*)

This apparatus last described is worked with one electric circuit, in the following manner:—The apparatus is shown arranged for transmitting a communication from the apparatus, marked "London"—the end of the apparatus, marked "Edinburgh," being shown in a condition for receiving the communication: and, in the event of it being desired to use the apparatus marked "Edinburgh" as the one from which a communication is to be made, and received at the end marked "London," then these apparatuses will respectively be put into the conditions the reverse of that now shown, which will readily be done by the persons at the respective places. The mechanically-composed communication consists of a perforated paper, which is cut (by a punch), as is shown on the portion of the paper at the apparatus marked "London"—the paper, wherever it is perforated, being so cut that each hole shall either extend partly over the parts o^2 and o^3 of the barrel o, or else over the parts o^2 and o^1 of the barrel o, the effect of which will be, that electric currents from a galvanic battery stationed at A at the end of the apparatus marked "London," will be transmitted through the marking instruments p and q at the end of the apparatus marked "Edinburgh," and by them to the passing chemically-prepared paper (in a moist state), the mark being at all times produced by the marker p or q, from which the electric current is for the time being caused to pass; and the arrangement of the apparatus is such, that the current passing from either instrument p or q, will go to the other instrument p or q, and thence back to the battery at the distant place. The instruments p and q are two metal springs, each carrying a copper point at its end, which constantly presses against the passing chemically-prepared paper: these springs are fixed to the barrel r, of hard wood, and the barrel has at one end some ratchet-teeth formed on a circular plate r^2, and by means of the spring-catch r^1 the degree of pressure of the springs p and q is regulated, by winding the barrel r more or less round on its axis. To the spring p the telegraphic wire from the distant place is fastened by the screw, and to the spring q is affixed the short wire, putting the spring q in communication with the earth, as is well understood. At the end of the apparatus marked "London," the barrel r has four springs affixed to it, in like manner to that above described in respect to the springs p and q, and which are marked t and v and w and v. From the copper end of the battery, at A, a wire proceeds, which has a branch, so that it may be in connection with the springs w and v. From the zinc end of the battery a wire proceeds, which also has a branch, by which that end of the battery is put in connection with the spring t and v; by which arrangement an electric circuit may be completed by means of the barrel o acting either with the springs w and v or with the springs t and v. The apparatus, as shown, would at the supposed moment of time be transmitting, by the aid of the springs t v, there being a hole through the paper, so that the points of these springs are in metallic communication with the parts o^2 and o^3, whilst the other springs w and v will be insulated from the barrel o by the unperforated paper under the points of those springs. The electric current will therefore at such instant of time be proceeding through the wire from the copper end of the battery at A, thence through the spring v, working in combination with t, and from the part o^2 of the barrel o, through the telegraphic wire, being at all times in communication with the part o^2 of the barrel, by means of a metal spring, as is shown. Hence the electric current will pass through the spring p at the other end, and make a mark thereby on the chemically-prepared paper; then it will pass to the point of the spring q, and thence down to the earth, and from the earth it will, by the wire x, pass to the spring x^1, fixed on the barrel r, and from that spring to the barrel o, and from the part o^3 of the barrel o the electric current will pass through the spring t, and thence to the zinc end of the battery. In the event of the next perforation in the paper coming under the points of the springs w and v, the current of electricity will pass in the opposite direction, that is, through the earth, by passing from the copper end of the battery through the spring w to the part o^1, and from thence to the wire x to the earth, and thence to the spring q, which, in this case, would be the marking instrument, and from the spring q to the spring p, and thence through the telegraphic wire to the part o^3 of the barrel o, from which it would pass by the spring v, which works with w, to the zinc end of the battery; and it will be evident that, if it be desired to make long marks, as shown in the table or card No. 1, the paper will be cut accordingly.

Figs. 14 and 15 represent an apparatus like that above described, but worked by the aid of two batteries, in which case the barrel

* Fig. 11,* on the preceding page, is a vertical section of the apparatus of which other views are given in figs. 9, 10, and 11.

Digitized by Google

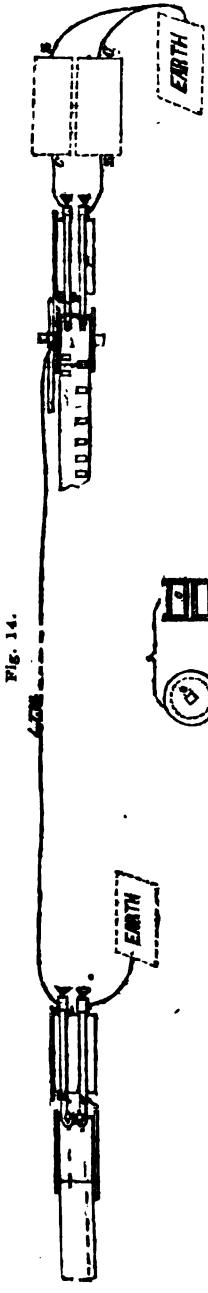


Fig. 14.

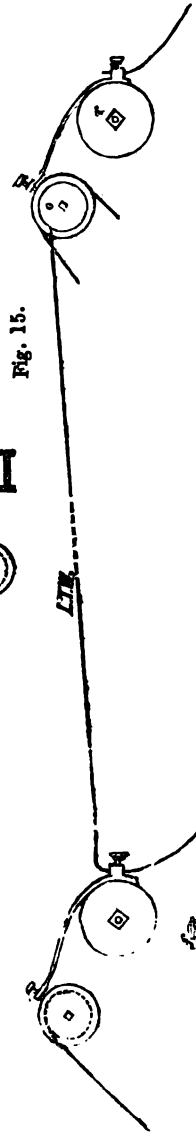


Fig. 15.

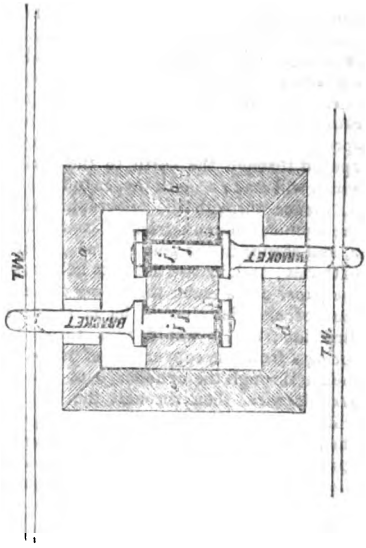


Fig. 21.

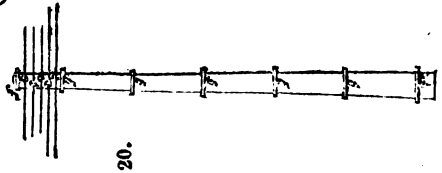


Fig. 20.

Digitized by Google

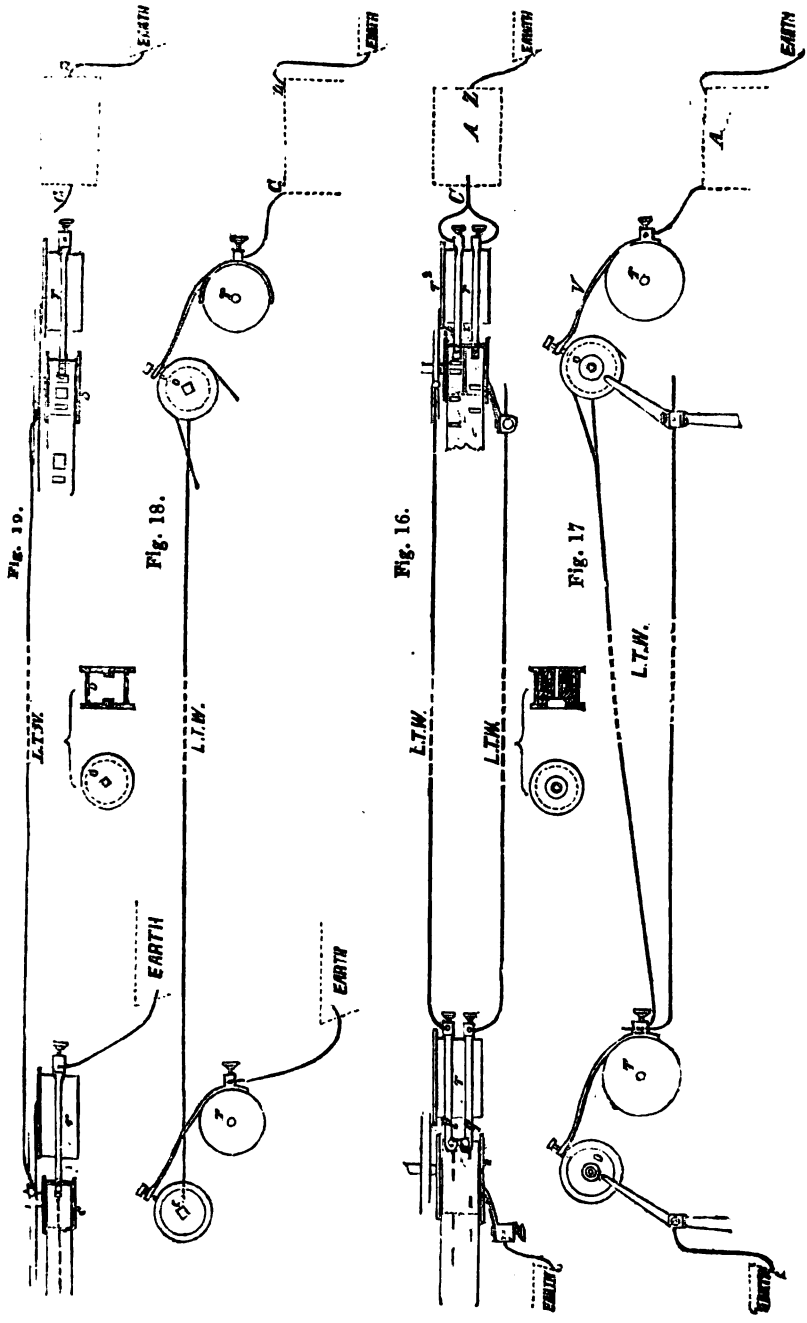
r would only have two springs *t* and *v*, and the perforations in the paper would be cut so as to come under the point of only one of these springs, and the spring *t* would be in connection with the copper end of one battery, and the spring *v* would be in connection with the zinc end of the other battery, the opposite ends of each battery being by a branch wire connected with the earth. The telegraphic wire being in connection with the cylinder *o*, which, in this case, will be a simple cylinder of metal, the receiving end of the apparatus would be fitted or arranged as before. The apparatus is shown in the position of having a perforation in the paper under the point of the spring *v*, by which means the circuit will be opened through the earth to the spring *q*, which will make a mark thence to the spring *p*, thence through the telegraphic wire to the cylinder *o*, and from it to the spring *v*, and thence to the zinc end of one of the batteries; and, in case the next hole through the paper come under the spring *t*, the current of electricity would be in the reverse direction; for it would pass through the spring *t* from the copper end of its battery, thence through the cylinder *o* to the telegraphic wire, then through the spring *p*, which would make a mark on the passing chemically-prepared paper, then through the spring *q* to the earth, and by the earth to the zinc end of the battery. Two telegraphic wires, kept well insulated from each other, may be used in transmitting and receiving communications, as shown at figs. 16 and 17, which figures show a plan and side view of so much of the apparatus as will enable me to explain this arrangement. In this arrangement the barrel *o* would be made of two parts, insulated from each other, and one of the telegraphic wires would be in connection with one part at one end, and also with the spring *p* at the other end; and the other telegraphic wire would be in connection with the other part of the cylinder *o* at one end, and also with the spring *q* at the other end; and the cylinder *o* at the receiving end of the apparatus would, by a branch wire and spring, be in connection with the earth: the springs *t*, *v*, at the transmitting end of the apparatus, would be in connection with one end of a battery at A, the other end of the battery being in connection with the earth. The perforated paper in this case is like that last described, the perforations only coming under one of the springs *t* or *v*, and the electric currents will pass through the paper to the barrel *o*. The direction of the currents in this apparatus will readily be traced as they pass from the battery at A to one or other of the springs *t*, *v*, and thence through one or other of the electric wires to the spring *p q*, and thence to the earth, and from the earth to the other end of the battery. I have not thought it necessary to enter into any description of the means of giving signals by alarms or otherwise, between distant places, where my invention, as herein described, may be applied—the same forming no part of my invention.

And I would state that my apparatus may be used separately from other electrical telegraphs, or may be used in conjunction with other electrical telegraphs; which latter may by some be considered the most preferable, as all communications are not required to be written and recorded. And I would state, that in some cases, parties may be desirous of receiving the written communication in such a state that others could not read it, in which cases it will only be necessary to saturate the paper with the solution of sulphuric acid, and deliver the paper (after it has received the electrical written communication from the correspondent at a distance) to the party in that state; when the party receiving the paper may bring out or render visible the writing, by subjecting the paper to the other part of the solution above mentioned; and should the paper not be delivered to the party in the apparently unmarked state, he will know that the paper has been acted on improperly, between receiving the communication on to it and its being transmitted to him. In like manner an apparatus may be arranged for working, with only one marking point and one transmitting point, as shown at figs. 18 and 19, which show a side view and a plan of so much of the apparatus as will, aided by the description already given, enable a person at once to understand this arrangement. It should be stated, that in all cases, the receiving cylinder *g*, as shown, is a simple cylinder of metal. The card or table No. II. shows a suitable arrangement of signs for this apparatus.

Mr. Bain's specification gives also the following description of a mode of constructing the posts or uprights for carrying the telegraphic wires:

Fig. 20 shows a post, or upright, constructed according to this part of my invention. Fig. 21 is a transverse section of the same, full size. The object of the invention is to make the posts of several pieces, framed together, and combined by cast-iron hoops, which will have a tendency to descend on any shrinkage taking place. The post shown is made of four pieces, *a*, *b*, *c*, *d*, which, separately, are comparatively light and thin, but, framed together, as shown, are stiff and firm. *e* is a strong hard piece of dry wood, fixed at the upper part

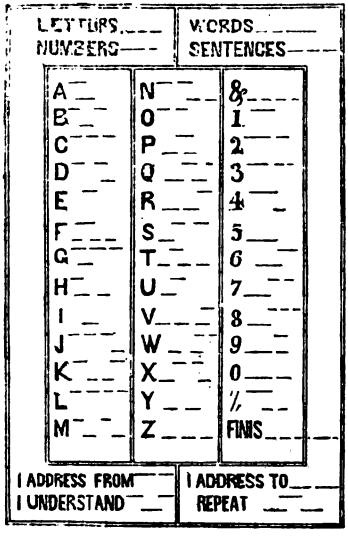
Digitized by Google



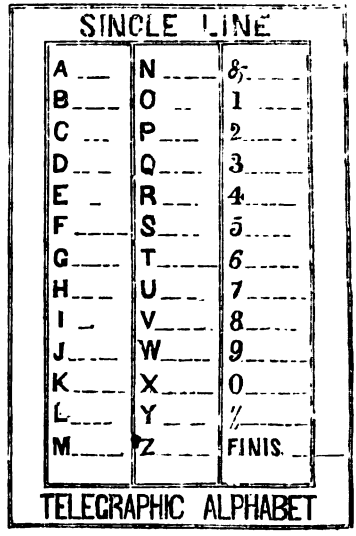
Digitized by Google

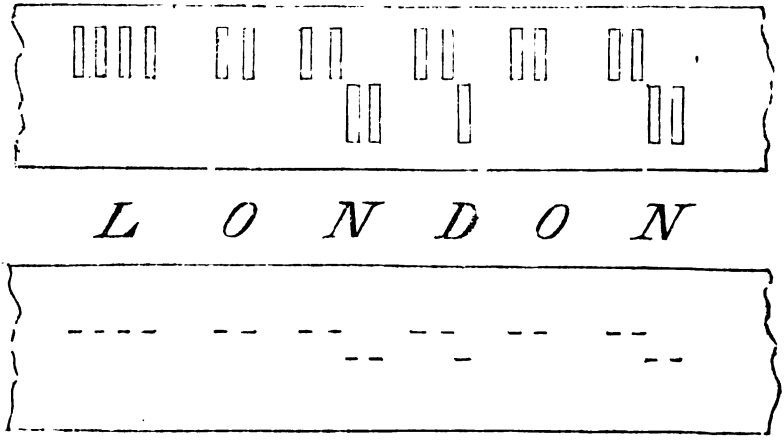
of the post or upright, into which the various brackets are fixed, as is shown, there being washers *i*, and tubes *j*, of India-rubber, or other suitable non-conductor of electricity, to keep the metal brackets insulated; and at the upper part is a cap *f*, which covers the upper part of the post;—and thus is the whole interior kept dry. *g g* are the cast-iron hoops which bind the whole of the parts together; and, as the post is larger at bottom than at top, any shrinkage will not injure the stability of the post, as the hoops will descend, and retain all parts secure.

No. I.



No. II.





Claims.—Having thus described the nature of my invention, and the best means I am acquainted with for performing the same, I would have it understood that I do not confine myself to the details, as herein described, so long as the peculiar character of either part of my invention be retained. But what I claim is, FIRST—The mode of arranging and combining apparatus for transmitting and receiving electrical tele-

Digitized by Google

graph communications, whereby mechanically-composed communications are transmitted through electric circuits, and are received by chemically-prepared surfaces—both apparatuses being kept in motion by mechanical means, without the aid of magnets, thus avoiding the comparatively slow process heretofore consequent on the making and unmaking of electro magnets at each time of producing a mark. And also I claim the mode of arranging electric apparatus so as to obtain two separate and distinct marks or signs by one electric circuit, as herein described.

And, SECONDLY—I claim the mode of constructing posts, or uprights, for supporting telegraphic wires for electric telegraphs, as herein described.

AMERICAN PATENT LAW CASE.—PLANING, TONGUEING, AND GROOVING MACHINERY.

[We copy from a late No. of the *Eureka* of New York the following judgment delivered by Judge Kane in a case *Smith and Sloat* v. *Mercer and Pechin*. We do so for two reasons: first, the great ability displayed in the judgment—which will bear a comparison with the best patent decisions of the judges of the mother country; and, second, for the clear light that it throws on a branch of mechanics of great and universal interest. ED. M. M.]

The Judgment.

Smith and Sloat v. *Mercer and Pechin.*

His Honour JUDGE KANE.

This case came before the court on bill and affidavits, upon a motion to restrain the defendants, by special injunction, from constructing, selling, and using Woodworth's planing, tongueing, and grooving machine, or any of the parts or combinations thereof.

It was very fully examined and ably argued by the gentlemen who are of counsel in the several cases growing out of Mr. Woodworth's patent right; and it was agreed that the evidence adduced in the case of Sloat and Plympton, which was considered immediately after this, should be applied to both cases.

The facts, so far as they are undisputed, are these:

On the 27th December, 1828, letters patent were issued to William Woodworth, of Troy, in the State of New York, conferring on him exclusive property of his "Improvement in the method of planing, tongueing, grooving, and cutting into mouldings, or other, plank, boards, or other material."

The patentee having died on the 9th of February, 1839, letters of administration on his estate were duly granted to his son, William W. Woodworth, by the Surrogate of New York, at which place the father was residing at the time of his death.

On the 29th July, 1842, the administrator applied for an extension of the patent for seven years: and the Board of Commissioners, to whom the application was referred, under the act of 1836, having certified in his favour, the patent was extended in the name of the administrator as such.

On the 8th July following, the administrator surrendered his letters patent, in accordance with the previsions of the 13th section of the act of 1836, for the purpose of obtaining a renewal upon an "amended specification, describing the invention in more full, clear, and exact terms," and the amended patent issued to him on the same day, under the hand of the Secretary of State, countersigned and sealed with the seal of the Patent Office, by "Henry H. Sylvester, acting Commissioner of Patents."

The complainants claim, under a grant of the exclusive right within and throughout the county of Philadelphia, made by the administrator, on the 29th November, 1842, and duly recorded.

It is admitted, that the defendants, Plympton and Hogeland, have been using, and they claim the right to use again, a machine, known as Ira Gay's, which effects the same purposes as Woodworth's, and which is alleged by the complainants to be in principle and substantially the same.

Upon these facts several preliminary questions have been discussed by the counsel for the parties, which I shall briefly consider.

1. It is said, that the administrator had no power to surrender the patent of 1828, after assigning exclusive rights under it, and that the new letters patent, being founded on such surrender, are void.

It is not easy to see how this objection, if valid, could affect the case before the court. The complainants do not claim under the new letters patent, but under the old; and these cannot have been invalidated by an unlawful surrender of them.

But it seems to me a mistake to regard the complainants, or any other persons whose rights have been brought to the notice of the court, as assignees within the meaning of the patent laws. There are four classes of persons recognized by the 13th and 14th sections of the act of 1836, as parties "interested." These are the original patentees, their executors or administrators, their assignees, and the grantees under them of the exclusive right for a specified part of the United States. These last, by the express

Digitized by Google

words of the 14th section, have the same rights of suit as the patentee or his assignees: and it is by force of this that the complainants, who are merely grantees of a limited right, are admitted as parties here. But they have no power over the letters patent: these remain with the party to whom they were issued, or the general representative of his interest; and the power of surrendering them for amendment and renewal is vested exclusively by the 13th section in the "patentee, his executors, and administrators, or the assignee of the original patent." The administrator, therefore, upon the facts disclosed, was the only person who could make the surrender and receive the amended patent; and there is nothing in the act of Congress which restricts his right to do so, because of his having previously made special or limited grants or licenses.

2. It is said, that the amendment of the specification, as made upon the re-issue of the patent in 1845, do not enure to the benefit of the assignees or grantees under the patent, as it stood before; in other words, that they must stand or fall with the original specification.

I cannot assent to this. The complainants are not grantees of the patent, or any part of it: they are grantees of certain rights, of which the letters patent are the evidence and definition. If those rights are made more clear and definite (not more extensive) by any new or additional act whatever, from whomsoever proceeding, why shall the complainants be denied the advantage of using that clearer and less equivocal evidence?

This is not the case of a surrender and re-issue with amended specification, where the grantee for a district prefers resting his claims on the specification as it stood when he purchased his right. As where the patentee makes a disclaimer of part of the invention, the prior grantee might in such case refuse to be affected by it. But here the objection comes from third persons: the complainants adopt the amended specification, by making it part of their bill; and the only inquiry is, as to their authority for doing so. The question is settled as to third parties by the provision of the act, that the amended specification shall have the same effect and operation in law, on the trial of actions, as though it had been originally filed in its corrected form.

3. The 5th section of the act of 1836, directs that all patents shall be issued under the seal of the patent office, and be signed by the Secretary of State, and countersigned by the Commissioner: it is argued that this patent is invalid, because signed by an *acting Commissioner*.

Mr. Sylvester, the countersigning officer, was the chief clerk of the Patent Office at the time; and as such, by the words of the 2nd section of the act, in all cases, during the necessary absence of the Commissioner, or when the principal office became vacant, had the charge and custody of the seal, records, and other things belonging to the office, and was required to "perform the duties of Commissioner *during such vacancy*." It is contended by the complainants, that the words "during such vacancy," apply as well to the case of the necessary absence of the Commissioner as to that of the commissionership being vacant by death, resignation, or removal.

This may be a grave question. I am not prepared to say, that the absence of the Commissioner, while he retains his official character, constitutes a vacancy in the office; or that the inferior officer can succeed to or exercise the powers of the principal station, while that station has a lawful incumbent. But I do not regard the question as properly before me, at least at the present stage of the cause. I recognize the signature of the Secretary of State, the public seal of the Patent Office, and the counter signature of a person who has the custody of it during the absence of the principal commissioner, and the right to use and attest it in a certain contingency. I find him designating his official character for the time, by words that imply his legal substitution to the duty in question. There is no allegation of fraud or usurpation on his part: on the contrary, his act is sanctioned by the commissioner now acting in person.

It would be too much for me, in an interlocutory proceeding like this, to deny the validity of these letters patent. I am inclined rather to adopt for the time the language of Judge Story (in the case of Woodworth v. Stone, 1st Circ. May T. 1845), on a question not unlike the present, and take the counter-signature, as he did the re-issue of the patent, "to be a lawful exercise of the officer's authority, unless it is apparent on the very face of the patent that he has exceeded his authority."

4. It is contended that the grantee of a right under letters patent cannot maintain a suit in a circuit which forms part of Pennsylvania, if he derives his title through a foreign administrator.

This idea refers itself to the local laws of Pennsylvania, which, as it seems to me, have no application to the case. By the act of 1836, "*all* actions, suits, controversies, and cases" whatever, arising under the patent laws, are without any exception originally cognizable in the courts of the United States; and it has been held in the only

Digitized by Google

case in which the question has arisen (Parsons *v.* Barnard, 7 Johns. 144), that this jurisdiction is exclusive. The right which is vested by letters patent, has its origin in the patent laws, and is transferable and transmissible according to their provisions. On the death of the patentee in this case, it passed under them to his administrator; and as it was a personal right, the administrator constituted by the forum of the domicil became liable to account for it. If the right has been since violated, he may sue for damages in his own name, as for a wrong to his possession: if he has sold it in whole or in part, he may recover the price in his own name, as for a breach of contract with himself. (Grier *v.* Huston, 8 S. & R. 402, Wolfersberger *v.* Bucher, 10 S. & R. 13.) I cannot doubt, therefore, that William W. Woodworth, the administrator, to whom the letters patent passed upon the death of the patentee, might himself have maintained an action in the Circuit Court for a breach of the patent right, without taking out new letters of administration in Pennsylvania.

Still less can I doubt the power of this court to interpose by injunction in such a case, to prevent an intended violation of right. It would be almost equivalent to a judicial repeal of the letters patent upon the death of the patentee, to affirm that the restraining action of the courts shall have no operation beyond those of the twenty-eight or thirty States in which the patentee is represented by local administrator.

But were the law in this particular otherwise than as I believe it to be, it is by no means true that the incapacity of a foreign administrator to sue implies the same consequence to his alienee. On the contrary, it has been expressly declared by the highest of our courts, that where a plaintiff's title is derived through a foreign administration, it may be asserted in a judicial proceeding here, without constituting a domestic administrator. (Trecothick *v.* Austin, 4 Ma. 35—6; Harper *v.* Butler, 2 Pet. 239).

5. A good deal of evidence was adduced to show that the amended specification describes a different improvement from that which is embraced in the original patent; and it was argued, that the amended patent was invalidated by the variance.

This, however, on the authority of Judge Story, in a case affecting this very patent (Woodworth *v.* Stone, *ut supra*), I do not regard as open to question at this time. "It appears to me," he said, "that prima facie, and at all events in this stage of the cause, it must be taken to be true that the new patent is for the same invention as the old patent; and that the only difference is, not in the invention itself, but in the specification of it. * * * * For the purpose of the injunction, if for nothing else, I must take the invention to be the same in both patents, after the Commissioner of Patents has so decided by granting a new patent."

Though thus relieved from the necessity of passing upon the question, I feel bound to remark, that the evidence has not satisfied me of the fact it was intended to establish. The very title of the patent, in the words of the inventor, "his improvement in the method of planing, tongueing, and grooving, *or either*," and the expression in the body of the specification, that after the planing is completed, the tongueing and grooving apparatus is to be used "*if required*," indicate to me that the patentee had in his mind from the first, a machine of several parts or systems, which could be used separately or in combination, as his administrator has developed more fully in the amended specification. So, too, his omission to declare in the first specification, that he employs rollers for retaining the board in its place while planing, though fully set out in his amended specification, cannot, in my view, support the idea that the inventions described are not essentially the same. The rollers, which he refers to in the first specification, and which are more unequivocally shown in the drawing annexed to it, as giving motion to the board, would almost necessarily perform the double office: besides which, there are other devices well known to mechanics, which could be conveniently adapted to the object. I see nothing in the two specifications which could justify me in referring them to different machines.

These preliminary objections being disposed of, three questions present themselves:

1. Was William Woodworth the inventor of the machine, for which he obtained letters patent in December, 1828?
2. Has he had, since the issuing of the letters patent, such an exclusive and continued possession under them; or have his rights as patentee been so vindicated by judicial action, as to claim for him the summary intervention of equity at this time for his protection and repose?
3. Is the machine now made or used by the defendants the same in principle and substance with the machine so patented, or with any material and distinguishable part of it?

1, 2. The two first of these questions have been so often decided in the Circuit Courts of the United States, as to dispense with the consideration of them at this time. In the case of Van Hook against Scudder, in the Circuit Court for the Southern District of New York, in 1843; and in another

Digitized by Google

case in the northern district of the same state; in that of Wilson *v.* Curtis in the fifth circuit, Louisiana district; in Washbourn *v.* Gould, in the first circuit, before Judge Story, at May term, 1844; and in twenty other cases decided summarily immediately afterwards by the same judge; and again, in Woodworth *v.* Stone, at May term, 1845;—in all of these, and in numerous other cases which have been alluded to in the arguments, the Woodworth patent has been recognized as valid, and the claimant under it as entitled to protection by injunction.

Two cases only have been mentioned, as implying a different opinion. The first is that of Woodworth *v.* Wilson, in the Circuit Court for Kentucky, where an injunction which had been granted was dissolved after more full hearing. But in this case the decree dissolving the injunction was reversed by the Supreme Court at its last session, and a perpetual injunction directed.

The other case is that of Richards *v.* Swimley, on the Equity side of this court, No. 1, of April sessions, 1841, in which Judge Hopkinson is supposed to have refused an injunction to claimants under the Woodworth patent, against a person who used a machine closely resembling that of these defendants. But an inspection of the record shows the supposition to be mistaken. The bill in that case was filed on November 4, 1840; and notice was given of a motion for an injunction, to be made of the 14th. On that day the complainants filed two affidavits, which defined the infraction to consist in the use of Woodworth's tongueing and grooving apparatus, making no mention of the machinery for planing. It does not appear that the motion was ever heard; and on the 16th, two days after the time noticed for making it, it was withdrawn by the complainants; since which no proceedings have been had in the cause. The right of the complainants in the machine expired in 1842. No judicial opinion on the part of Judge Hopkinson can be inferred from these facts; and I am left therefore to the concurrent judgments that have been pronounced in other circuits.

I may add, that my own very careful examination of the different inventions that are supposed to interfere with Woodworth's has not led me to a different conclusion from that which a proper judicial comity invites me to adopt.

3. The only remaining question is that which regards the substantial identity of the machine used by the defendants with that patented by Woodworth.

The patent of Woodworth, as defined in his amended specification, is for a machine, capable of performing the operations of planing, tongueing, and grooving, at one and the same time, but which admits of their being performed separately. It consists essentially of two parts or systems; one for the planing or smoothing the surface; the other for fashioning the tongue and groove upon the edges.—The apparatus for feeding the machine, and the rollers by which the elastic material is held firm while undergoing its action, are subsidiary to these.

I shall consider the two systems of machinery in succession.

1. The planing machine.

A practically smooth surface may be given to plank or other substances, by the application of either of three forms of tools:—the chisel, which, with a gauge to regulate its action, becomes the ordinary plane; the drawing-knife, which, with a similar gauge, forms the spoke-shaver, and the adz. Each of these has its appropriate or characteristic motion; though by the ingenuity of the workman, the motion of either of them can be modified so as to approach that of another.

The chisel, when in the form of the plane, has its blade fixed at an acute angle with the surface to be reduced, and works parallel to that surface, the edge cutting generally at right angles.

The gauged drawing-knife differs from the plane in this; that by means of its two handles, its edge can be made to cut obliquely, or at right angles, at the pleasure of the workman. Its general motion is parallel to the surface; though being more under control of the hand; and having its blade sometimes slightly arched, it may be made to deviate upwards or downwards, with a varying angle, or in a curve.

The adz has an arched edge, and cuts only in curves; the level surface being attained proximately by a succession of such cuts.—The plane and drawing-knife operate by shaving the surface, the adz by chipping.

The chisel-plane was combined with apparatus for giving it motion and direction, in the machines of Bentham, in 1791, Bramah in 1802, and Muir of Glasgow in 1827. In the first and last of these, the character and direction of the motion were those of the same tool when worked by hand. In Bramah's, the planing blades of iron were fixed upon a revolving disc; the character of the motion thus becomes circular, but still continuing to be parallel with the surface.

The planing machine of Woodworth, though it uses knives or cutters resembling plane irons in form, is essentially a series of adzes. These are attached to the outside of a cylinder, in lines either parallel or oblique to its axis; and as the cylinder re-

Digitized by Google

valves, they cut with an adz-like or dubbing motion; the knife, which is parallel to the axis, presenting its whole edge to the plank at the same moment, and in this respect cutting like the plane; the knife which is oblique, or in the helix form, presenting the parts of the edge in succession, and in this respect cutting like the drawing-knife; but both forms of knife cutting in vertical curves like the adz, not in plain surfaces like the chisel-plane, and its combinations by Bentham, Bramah, and Muir.

Regarding, then, the Woodworth machine as substantially different from the three last mentioned, I find the substantial difference to consist in this, that they act in planes parallel to the surface to be removed, Woodworth's in vertical curves; that theirs produce an absolutely level surface, his a surface apparently level, but in fact corrugated or grooved.

2. The tongueing and grooving machine.

The idea of tongueing and grooving by modifications of the circular saw is at least as old as 1793, when it was described by General Bentham, from whom Muir copied his machine many years after. The specification of the two coneur in describing a thick revolving saw, or cutter, to make the groove, and two wheel-saws set at right angles with each other on each side the plank, making four in all, to cut the rebates of the tongue. The machine of Woodworth is an improvement on these, by substituting a single firm cutting wheel for the four circular tongueing-saws, and combining this with the equally firm grooving cutter on the other edge of the plank, to reduce it to an exactly equal width throughout.

I do not see an essential difference between the grooving cutter in this machine, and the circular saw, or cutter, described by Bentham and Muir. But their tongueing apparatus is clearly not the same as Woodworth's; and I doubt very much whether the tongueing and the grooving could be practically combined in their machines with the same effect as they are in his; they certainly are not.

These two systems of machinery, the planing, and the tongueing and grooving, seem to me to constitute the essential, and only essential, parts of the Woodworth improvement. The amended specification claims them, in the several combinations of which they are susceptible, as follows:

1. The employment of the rotating planes in combination with the subsidiary rollers, or any analogous device:

2. The combination of those planes with the tongueing and grooving wheels:

3. The combination of the tongueing with the grooving apparatus:

4. The combination of either the tongueing or grooving wheels with the rollers, which by their pressure hold the plank steady in its place.

Having thus analyzed the patent right under which the complainants claim, it remains to determine whether the machine used by the defendants is in part or in whole substantially the same.

And 1. Of the planing machine.*

an absolutely plane surface, it loses one of the characteristics of his machine.

On the other hand, it is clear, that a machine, sensibly like Woodworth's, may not exactly conform in its structure to the rigid definition of a cylinder. The smallest change of diameter between the two ends of the revolver, on which the planing knives are placed, would convert the cylinder into the frustrum of a cone; and a corresponding inclination of the axis of motion, or a corresponding adjustment of the plank to be acted on, would make the machines operate as well, or nearly as well, as if the exact character of the cylinder had been retained.

Yet, just in proportion as the sides of the Woodworth revolver approximate to a cone, the machine approaches the planing disc of Bramah. It ceases to cut as the adz merely, but takes in some degree the characteristic action of the chisel-plane and drawing-knife.

So, too, when you give a *dished* form to the disc of Bramah, thus converting the disc into a cone, you lose in part the characteristic action of the chisel-plane and drawing-knife, and introduce in the same degree the appropriate motion of the adz.

This deviation from the strict form of the Woodworth machine towards that of the Bramah, or from the Bramah towards the Woodworth, may go on increasing, till the appropriate action of the original machine effectively disappears; the cylinder, by a series of progressive changes, having lost itself in the disc, or the disc in the cylinder. It is impossible to define, for the practical objects of a judicial decree, that angle or degree of deviation at which one of these geometric forms shall be said to pass into the other.

Between the two machines, then, the Bramah, unprotected by a patent in this country, try, which cuts parallel to the surface with a planing motion, and the Woodworth, which cuts with the dubbing action of the adz,—where is the line of separation? Obviously, it is at the point of the first deviation from the free machine to that of which the use is prohibited.

Turning now to the machine used by the defendants, we find it to be a revolving cone,

* *Sic* in the judgment as given in the *Eureka*, but there is evidently some omission here.—Ed. M. M.

Digitized by Google

its axis or spindle so arranged as that the tangent plane of its curve shall coincide with the surface to be made smooth. It partakes of the disc character, and cuts as the drawing-knife and chisel-plane also; but just so far as it varies from the simple disc of Bramah, it embraces the principle of Woodworth's machine, by involving the dubbing action of the adz. It cuts as the drawing-knife, and the plane, while approaching the point at which the knives act upon the finished surface, and its cutters continue to revolve with a similar motion after passing that point; but at the effective moment, it is not the plane or the drawknife, but the adz cut, that furnishes the work.

Much stress has been laid upon the fact, that the knives in the defendants' machine are not in the lines of the radius, but have a certain obliquity, which brings one part of the edge in contact with the board before the rest, and gives a sloping or drawing action, not unlike that of the pocket-knife while cutting a stick. But I see nothing in this action or arrangement to distinguish it in principle or substance from that of the Woodworth rotary cutter, when placed in the oblique line of the helix. Whether it be the knife that moves in part lengthwise during its revolutions, presenting the points of its edge to the board in succession, or the board, which, moving onwards, presents its face to the several points in succession of the knife edge, or whether the action results from the combined motion of the two, the machine and its mode of operation are substantially the same.

I am therefore of opinion that the planing machine of the defendants is an infringement of the complainants' patent right.

2. As to the tongueing and grooving machine.

This part of the machine in use by the defendants does not vary sensibly in form or character from the tongueing and grooving apparatus claimed by Woodworth. Until his patent shall be invalidated, he has a right to claim of this court the protection of its restraining process in regard to this also.

It is my duty, therefore, to grant the full injunction as prayed for. In doing so, I am not insensible to that which was so ably pressed in argument, that if I am in error, the respondents may be seriously prejudiced. But the court can seldom encounter a case that does not involve a similar responsibility for consequences. To withold judicial action is not to escape from this. The right of a party to the most speedy and effectual protection against a meditated wrong, is as complete as his right to his redress for wrongs already inflicted: and the accident of position confers no right on one party, whether he be plaintiff or defendant, at the expense of the other. The special injunction of equity, like the arrest on mesne process of the law, may be abused to the injury of an opponent; but it is no less on that account the duty of the judge to further them both, when, in the exercise of his best discretion, he believes that they are called for by the merits and the exigency.

This is a case of an ancient and highly important patent-right. It has been contested at law and in equity with an eagerness and pertinacity proportioned to its value. Yet, during the lifetime of the inventor, eleven years, it was "never successfully impeached." (Story, J., in Washbourn *v.* Gould.) There is here no acquiescence, no laches; but, on the contrary, all promptness and vigilance.

I accordingly direct a special injunction to issue according to the prayer of the bill, and to remain until the hearing of the cause, or the further order of this court.

EXPLOSION OF AN AMERICAN LOCOMOTIVE—REPORT OF A COMMITTEE OF THE FRANKLIN INSTITUTE ON THE CAUSES OF THE ACCIDENT.

The Committee on Science and the Arts, constituted by the Franklin Institute of the state of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred the examination into the causes of the explosion of the locomotive engine "Neversink," upon the Reading Railroad, on the evening of the 14th of January last,

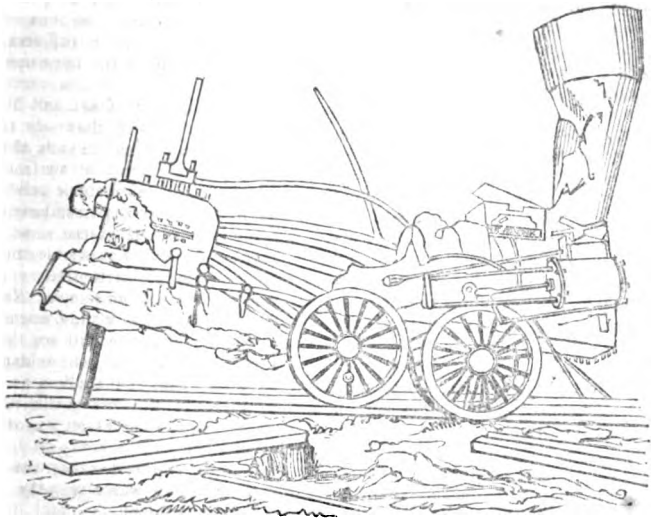
Report,

That they have collected all the evidence bearing upon the subject which they could obtain, and have visited Reading for the purpose of examining the wreck of the engine. The following is the result of their inquiries:

The engine "Neversink" was originally built by Baldwin, and sent upon the road in April, 1836. It then weighed 10½ tons, and had six wheels, two of which were drivers. The engine was thoroughly renewed, and rebuilt by the Reading Railway Company, at their Reading depôt in April, 1846, and was changed to an engine of 19 tons, on six wheels, all connected drivers.

In rebuilding it, four plates in length at the fire-box end of the cylindrical part of

Digitized by Google



the boiler were retained, and 1½ sheets in length were added at the front end of the boiler. The new iron was $\frac{9}{16}$ths of an inch in thickness, the old one-fourth of an inch. The vertical part of the boiler was 51 inches in diameter; the fire-box was 39 inches long, 37 inches wide, and 44 inches high, the crown was stayed with wrought iron bridge bars, and was so strong that it received no damage from the explosion. The horizontal portion of the boiler was 41½ inches in diameter, and 11 feet 6 inches in length between the tube sheets. The smoke-box was 2 feet 3 inches in depth, making a total length of boiler of 18 feet. There were 128 wrought iron tubes 2 inches in internal diameter, and one-eighth of an inch thick in the wall; they had copper ends at the fire-box tube sheets.

There was but one safety valve, 2¾ inches in diameter, placed upon the dome; there were four gauge cocks, the lower one of which was 8 inches above the crown-sheet, and the upper one about 14 inches above the lower.

The highest tube was 1½ inch below the crown of the fire-box, and 11½ inches below the top of the cylindrical part of the boiler.

The fire surface reduced to fire-box surface, amounted to 309 square feet.

The cylinders were 13½ inches by 20. The driving wheels 46 inches in diameter.

It was a favourate engine upon the road, and had run, previous to alteration, in

April, 1846	71,010 miles.
Afterwards	18,041 ,,
Total	89,051 miles.

Upon their examination, the committee found the horizontal part of the boiler almost completely destroyed. In this part of the boiler the explosion had manifestly originated, commencing in the older iron which remained in the hinder part of the boiler. The tubes were, for the most part, still fast in the tube-sheets, but they were bent outwards at their middle, like the staves of a barrel. The steam-pipe, as it passed through the boiler, was *collapsed*, but not broken. The outer shell of the boiler had been torn into fragments, and the rents had extended to the vertical part, the upper portion of which had been entirely torn away, so as to expose the fire-box, which was sound, but slightly caved in on the sides. The cylinders were unharmed by the explosion, but had since been removed. The quality of the iron appeared to the committee to be uniformly good.

There was, therefore, nothing about the engine to indicate that the accident had occurred from defects in workmanship or material, nor, indeed, did the tremendous power which was indicated, seem consistent with the idea of an originally defective boiler.

Through the kindness of the Railroad Superintendent, the committee had an opportunity of examining Patrick Fagan, the engine driver usually in charge of the "Neversink," whose testimony is in substance as follows, viz.:—

That, when in the hands of a driver who understood it, the "Neversink" was the best engine he ever knew, but that no one who did not understand the engine, could tell, by the gauge-cocks, how much water

Digitized by Google

there was in the boiler; that it would frequently throw water out of the safety-valve when the water-level was, in reality, below the second gauge; that the pumps were good, and had never given trouble when the water-level was kept up, and could always be made to act by opening the fire doors and cooling the fire down, but that when the water is low, and the engine hot, no pump will act; he "has worked the engine when, with both pumps on, he could not get the water up for an hour, but could always do so by running slow, and cooling the engine." Has carried 150 lbs. steam upon the engine, (the steam was then damp), but believes any engine is dangerous at that pressure, "as at that heat, a second will throw the water out." The pumps delivered the water into the boiler about 6 inches behind the smoke-box, and about half way up the tubes; the receiving valve was under the cylinder; the check valve between the cylinder and boiler, and the discharging valve close up to the boiler: the distance from the receiving to the check valve was about four or five inches, and about 20 or 24 inches from the check to the discharging valve. The engine was at this time in perfect order; had been brought down by the witness on the preceding Tuesday, and had laid over until Thursday night, when the witness went to the depôt for the purpose of taking it up again, but was recalled by a message from his sick wife, and the engine was entrusted to Jacob Salleburger, under whose charge it was when it exploded.

In reference to the behaviour of the engine, Mr. Kirk, the foreman of the shops of the Company at Reading, remarks, that he was not aware of any peculiar difficulty about the "Neversink," but that "all our large class engines are a little ticklish in carrying water." The cause of this we shall presently endeavour to show.

The accident occurred about 30 yards above Mill Creek bridge, and the watchman upon the bridge gives the following account of what he saw and heard:—

He was standing in front of his door when he heard the engine coming, and, as it approached, he noticed the peculiar loudness and sharpness of the exhaust; the engine was then running very fast, and was not blowing off steam. As it passed the bridge, one of the persons upon the platform was stooping down, apparently looking in at the fire doors, and as he rose, he put his hand either upon the safety-valve or upon one of the stays; almost immediately afterwards, the witness heard a very loud roaring like thunder, which he is sure was not the escape of steam from the safety-valve; this lasted about thirty seconds, when the explosion took place, by which he was knocked down, and saw no more; when he got up he ran immediately to the engine, but was so engaged attending to the sufferers, that he paid no attention to the appearance of the engine.

Mr. Nicolls, Mr. Kirk, and Mr. Fagan, all testify that, when they saw the engine next morning, the broken ends of the tubes, as far down as the fourth row from the top, were blue from the effects of overheating; a member of the committee, however, who was on the ground at the same time, declares that he could not perceive this, though he looked for it particularly; when the committee saw the engine, at Reading, no such appearance was visible, nor could it be expected, since a snow fell on the night of the accident, and subsequent oxidation would destroy all traces of the colour.

Neither did the fire-box give any observable indications of an exposure to an unusual heat. Yet there is no doubt in the minds of the committee that the want of a proper supply of water was the proximate cause of the accident.

The evaporative power of these heavy engines is necessarily very great. Mr. Nicolls assured the committee that the "Neversink" was capable of drawing a train of 88 cars, weighing, loaded, 7½ tons each, (equal to 637 tons), at a speed of 12 miles per hour. (1056 feet per minute). Allowing the traction to be 7½ pounds per ton, (as experiments upon this road show it to be), this is equivalent to 153 horses power—requiring an evaporation of 2·55 cubic feet of water per minute.

Now, by the peculiar construction of these engines, rendered necessary by the restricted space allowable for the boiler, when the water-level stood 2 inches above the lower cock, the steam was confined exclusively to the hemispherical dome above the fire-box, the cubic content of which is rather less than 24 cubic feet (23·8565 cubic feet). The cubic content of each cylinder (13·5 × 20) is 1·657 (1⅝) cubic feet, and, as two cylinders are drawn at once, the ratio of the cylindrical content is as 3·314 to 24, or more than one-eighth. When the water-level is at the upper gauge-cock, the steam room is nine cubic feet, and the ratio about one-third. Now, the most recent (and apparently the best) authority upon the high pressure engine declares, after nearly 30 years of practical experience, that "the steam space should be at a minimum 20 times as great as the space to be filled with steam in the cylinder. If it can be made greater, consistently with the other arrangements of the boiler, so much the better."* This is, of course, inapplicable in locomotive engines.

* Alban, on the high pressure engine, p. 90.

Digitized by Google

The reason, therefore, that these engines will throw water from the safety-valve, and from the gauge-cocks, when the actual water-level is dangerously low—and that, in the words of Mr. Kirk, "they are ticklish in carrying their water"—must be evident. The foaming in one of these engines must be incessant, and the danger of priming very great. The gauge-cocks, which, under the most favourable circumstances, are but indifferent indicators of the water-level, become, in this case, useless, and the engine driver must rely upon his experience of the engine, and trust to incessant watchfulness alone, if he would avoid an accident.

A very remarkable fact about this explosion is, that the steam pipe passing through the upper part of the boiler, from the throttle valve to the cylinders, was *collapsed* and broken, as will be seen in the accompanying Daguerreotype portrait of the engine, taken after the explosion by Mr. David Monday, of Reading, and kindly lent by him to the committee. It is, indeed, possible that this may have been produced, during the explosion, by the sudden bending upwards of the tube, otherwise it would seem to indicate that the engine was throttled at the time of the explosion; an expedient which may have been resorted to for the purpose of avoiding the dampness of the steam, or to check the speed of the engine; but the fearful danger of which will be seen when it is considered that, if the steam was shut off but one-fourth (the water being above the lower gauge-cock), the pressure in the boiler would double itself in about one minute.

It seems useless to speculate upon the immediate cause of this terrible accident since the death of all upon the engine has removed the direct testimony of the circumstances under which it occurred, except that of the watchman before referred to. From his evidence, however, it appears that the engine was under a very unusually heavy pressure of steam, and scarcely less certain that the safety-valve was (accidently or otherwise) fastened down.* Mr. Nicolls and Mr. Kirk both testify to the compentency of the engine driver who was in charge, and every one bears witness to his character for sobriety. That he may have been deceived as to the height of water in the boiler is possible from the character of the engine, although it is difficult to imagine how an experienced hand could heve neglected the indications given by the increased pressure, as shown by the rapid running of the train, and the sharpness of the exhaust.

* After having his attention repeatedly called to the importance of this part of his testimony, he still confidently asserted that no steam was escaping from the valve at the time the engine passed him.

Dr. Alban, in his recent treatise upon the high-pressure engine, before referred to, mentions a rumbling noise as often preceding explosions, and attributes it to the sudden loosening of the scale upon the boiler, and the increased access of water to unduly heated metal thus produced (p. 18). But the scale upon the tubes of the "Neversink" was not thick enough to produce any effect of this kind, nor does it appear to have been loosened to any extent. It seems, therefore more probable to the committee that the roaring noise referred to by the watchman as preceding the explosion, may have been caused by the starting of one or more of the tubes at the forward end, and the consequent escape of the steam into the smoke-box, the sudden diminution of pressure consequent upon which, would cause the rise of water in foam over the heated tubes, and thus almost instantaneously produce a pressure which no locomotive boiler could withstand.†

Upon the whole then, it appears probable to the committee that the explosion of the "Neversink" occurred in this way:—

That the engine was running under a heavy pressure of steam, and that, owing to the defective indications of the gauge-cocks, the water in the boilers was permitted to get below the upper tubes, which thus became unduly heated: that the rapidly increasing pressure (assisted, perhaps, by an injudicious partial closing of the throttle valve) caused the starting of one or more of the tubes from the forward tube-sheet, and this sudden relief of the pressure caused a foaming in the boiler, by which the water was thrown over the heated tubes, and being thus rapidly evaporated, caused an instantaneous increase of tension, which the additional openings were incompetent to relieve, and thus produced the rupture of the outer shell of the boiler. This, however, is intended only as a plausible suggestion, and by no means as a confident affirmation of the cause of the explosion.

But whatever hypothesis may be adopted to explain this unfortunate accident, its investigation has forcibly called the attention of the committee to several matters which

† The boiler of the "Neversink" being of wrought iron, one-fourth of an inch-thick (at minimum), and 41½ inches in diameter, would, according to Oliver Evans' rule, (Young Steam Engineers' Guide, p. 23), sustain a pressure of 51·4 atmos.

$$\text{The formula is } p = \frac{2\,s\,t}{d}:$$

Where p = the bursting pressure. s = a constant depending upon the tenacity of iron, =, according to Evans, 6400. t = thickness of iron in tenths of an inch. d = diameter, in inches,

$$\frac{12800 \times 2{\cdot}5}{41{\cdot}5} = 771 \text{ lbs.} = 51{\cdot}4 \text{ atmospheres.}$$

Digitized by Google

they believe to be of sufficient practical importance to deserve the attention of the Institute.

First. The necessity of providing all steam engines with a second safety-valve, of large dimensions, regulated to the maximum pressure which the engine is intended to bear, and placed beyond the control of the engine-man. It is true that this will entail upon the owners the trouble of frequent examination to maintain the efficiency of such a valve, but this trouble will be more than compensated by the increased safety which will be procured by its use.

Secondly. The uncertainty of the ordinary gauge-cocks, as indicators of the water level, under the most favourable circumstances, and the deceptive character of their indications upon the modern locomotive engines, where the amount of work to be done and the restricted space which can be allowed to the boiler, necessarily confines the water and steam room, and renders the evaporation more tumultuous than in the larger boilers of stationary engines.

The incompetency of the gauge-cocks to indicate the true water level, especially under high pressures, is admitted by most writers upon the steam engine (*Pole, on the Cornish Engine*, pp. 61, 108, note; *Alban on the High-pressure Steam Engine*, p. 111,) and is noticed in the report of the Franklin Institute Committee on Explosions (*Journal* vols. xvii., p. 8, *et seq.*, xviii., p. 295), who recommend the glass-tube water gauge, in which recommendation the present committee cordially join, believing that there are no objections to its use which cannot be easily overcome.

Thirdly. The committee would suggest the inquiry whether it is not feasible and advisable so to construct the locomotive engine that explosions, if they occur at all, shall take place in such a manner as to be less destructive to human life than they are at present. One of the great recommendations of the tubular boiler, when first introduced into use, was this very diminished liability to do injury, by allowing a tubular flue, of comparatively small size, to collapse, in place of the large cylinders, by which the boiler was at once emptied of its contents.

The perfect condition of the fire-box of the "Neversink" showed the committee how well the superintendent of the Reading Railroad has guarded against the determining cause of the explosion of the "Richmond," and the committee would earnestly recommend to him, and the ingenious mechanics with whom he has surrounded himself, as well as to our locomotive builders generally, to devote their attention to this matter of contriving some means by which the accidental explosions of these indispensable but dangerous machines may be rendered less destructive to those who are in charge of them.

By order of the Committee,
WM. HAMILTON, *Actuary.*

Philadelphia, March 11, 1847.

THE CENTURION PAPERS.—No. II.

(Continued from page 57.)

[In these times of election-excitement, the following question will have some interest. We do not think it has appeared before; but at any rate it is an excellent exercise in algebraic management, and the solution very neat.—ED. M.M.]

3. *Election Manœuvres.*

At a late election for the county of ———, there were four candidates A, B, C, D of the four several shades of political creed, radical, whig, conservative, and tory. Party spirit ran high, and each candidate professed to stand upon his own independent interest; and therefore tried to obtain as many plumpers as possible. However, secret coalitions were formed. A united with B, and supplied him with 453 split votes from his intended plumpers; but B was only able to repay the favour with 296 votes. On the evening of the first day's election B received overtures from C for a secret coalition, and supplied him with 187 votes, and received in return 176 from C. The next morning C formed a treaty with D, which gave him the benefit of 135 votes, for which he is able to give in return 163.

Now D has of actual plumpers 504 less than A and B together. It was also found that of the independent voters 2426 voted for A and B; 2604 for B and C; and 2301 for C and D. Moreover, the number of the voters for A and B together was 15305; for B and C together, 15625; and for C and D together 14196; whilst from various reasons 183 electors did not exercise their franchise at all.

Which were the successful candidates—how many plumpers did each calculate upon at the outset—what was the constituency — and which candidates would have "got in," had there been no coalition formed?

Solution.

Let u, w, y, z be the plumpers which

Digitized by Google

were *actually* given to A, B, C, D respectively; then the coalitions and the independent votes, give for the numbers polled by each candidate as follows:

$$A's = u + (296) + (2426) = u + 2722 \ldots (1)$$
$$B's = x + (453 + 176) + (2426 + 2604) = x + 5659 \ldots (2)$$
$$C's = y + (187 + 135) + (2604 + 2301) = y + 5227 \ldots (3)$$
$$D's = z + (163) + (2301) = z + 2464 \ldots (4).$$

But by the conditions of the question, we have

$$x = u + x - 504 \ldots (5)$$

And

$$u + x + 2722 + 5659 = 15305, \text{ or } u + x = 6824 \ldots (6)$$
$$x + y + 5659 + 5227 = 15625, \text{ or } x + y = 4739 \ldots (7)$$
$$y + z + 5227 + 2464 = 14196, \text{ or } y + z = 6505 \ldots (8)$$

From (5, 6) we get

$$z + 504 = u + x = 6824, \text{ or}$$
$$z = 6320, \text{ the plumpers given to D} \ldots (9).$$

From (8, 9) we have

$$y + 6320 = 6505, \text{ or } y = 185 = \text{C's plumpers} \ldots (10).$$

From (7, 10) we have, similarly,

$$x + 185 = 4739, \text{ or } x = 4554 = \text{B's plumpers} \ldots (11)$$

and finally, from (6, 11) we get

$$u + 4554 = 6824, \text{ or } u = 2270 = \text{A's plumpers} \ldots (12).$$

From these it follows that the votes actually given for the several candidates respectively were as follows:

For A, $2270 + 2722 = 4992$,
... B, $4554 + 5659 = 10213$,
... C, $185 + 5227 = 5412$,
... D, $6320 + 2464 = 8784$.

Whence, the successful candidates were B and D.

Again; to find the number of plumpers which each candidate originally reckoned upon, it is obviously, only necessary to add to the numbers u, x, y, z actually obtained, the numbers which were respectively split by arrangement during the polling days.

A divided 453 of his plumpers with B, and retained 2270; whence he had promises of $2270 + 453 = 2723$ plumpers.

B supplied 296 splits to A and 187 to C; making therefore his promised plumpers to be $4554 + 296 + 187 = 5037$.

C retained 185, and split with B and D respectively 176 and 135 votes; whence the promised plumpers to C were $185 + 176 + 135 = 496$.

D retained 6320 plumpers and split 163 with C; and hence the number promised to him was $6320 + 163 = 6483$.

To find the constituency, in the next part of the problem.

Since those who voted for A and B were essentially distinct from those who voted for B and C, and each of these classes again distinct from those who voted for C and D (no elector having more than two votes), it follows that the sum of these three classes, constitutes the class of independent electors; or of those who had not promised plumpers to either of the candidates. That is,

$$2426 + 2604 + 2301 = 7331,$$

the number of independent voters.

These added to the sum of the *promised* plumpers, and to the number who did not vote at all, constitute the entire constituency, whence,

$$7331 + (2723 + 5037 + 496 + 6463) + 183 = 22233$$

the number of electors of the entire county.

It only remains to ascertain whether these manœuvres affected the independent result of the canvass. To find this we have only to subtract from the number polled by each candidate the votes which he obtained by the splits, in order to know what the final state of the poll would have been, had none of these conditions taken place. This gives:

For A, $4992 - 296 \ldots = 4696$,
... B, $10213 - 453 - 176 = 9584$,
... C, $5412 - 187 - 135 = 5190$,
... D, $8784 - 163 = 8621$.

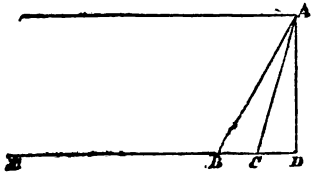
Wherefore the trickery of the scheme did not alter the return of the candidates B and D.

Digitized by Google

In the 4th volume of "Montucla's Histoire des Mathematiques," the following experiment is recorded—which, as being likely perhaps to interest some of your readers, and being contained in a work so little read or known to practical men, I here transcribe. Thevenard, the author of the experiment, is stated to have been "Capitaine de port à l'Orient." "L'auteur voulut connaitre par experience l'effet des lignes d'eau convexes et celui des mêmes lignes concaves vers la partie anterieure de la proue pour la marche des bâtimens. Dès 1757 il avoit essayé cette comparaison sur deux frégates de 26 canons qu'il contruisit à Grandville, toutes deux sur le même plan, avec des matures, des gréemens et des apparaux semblables; et presidant à ces operations pour obtenir une grande egalité entre elles, il eut soin d'en faire les chargemens de parties semblables pour les deux navires, tant en qualités ou pesanteurs qu'en quantités, et il presida à l'arrimage pour qu'ils fussent egaux en tout point; ils sortirent du port le même jour, entierement armés, il monta sur l'un d'eux pour comparer leurs courses et leurs evolutions, louvoyant dans la vaste baie de Cancalle, pour arriver au mouillage ordinaire de cette côté. Mais avec cette grande egalité qu'il tachoit d'obtenir entre ces bâtimens, il avoit mis une grande difference, peu sensibles aux yeux du vulgaire, qui n'en pouvoit prevoir les consequences: l'une de ces frégates avoit la quille plus courte de 8 pieds que la seconde, c'est à dire, que sur une même longueur absolue de flotaison, la première avoit 12 pieds d'elancement d'etrave, et l'autre 4 pieds seulement; et les marins jugeoient que ce bâtiment auquel ils voyoient ce qu'ils nommoient une pince et une forme apparente alguë vers l'endroit le plus bas de la proue, auroit l'avantage pour mieux marcher et mieux pincer au vent que son competiteur. Sans être entièrement opposé à cet avis, le citoyen Thevenard avoit des doutes par lesquels il avoit fondé en secret l'essai et la comparaison qu'il vouloit faire pour l'avantage de l'art.

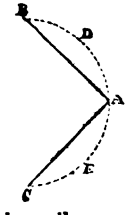
"Le résultat de toutes les observations sur les manœuvres, les mouvements, et les vitesses de ces frégates fut que la première, dont la quille etoit raccourcie de 8 pieds, qui n'avoit pas cette pince, dont la vue avoit été séduite, dont les lignes d'eau vers la partie basse de l'avant n'étoient point concaves, marchait mieux sous toutes les allures, tenoit un peu mieux au vent, et viroit de bord avec un peu plus d'aisance que celle dont la quille, plus longue de 8 pieds, sembloit devoir procurer plus de parties laterales contre la dérive, et mieux diviser l'eau."

The phrase "elancement d'etrave," corresponds, I believe, to the English "rake of the stem," and is measured by the angle which the stem makes with the vertical: thus,



if AB and AC be the stems of the two frigates, AD a perpendicular to the keel ED, the frigates being in other respects equal, or AD the same for both, the "elancement d'etrave" of one would be measured by BD=12 feet, and that of the other by CD=4 feet.

With reference to this and all other similar experiments, there is one circumstance which ought never to be forgotten (as it often has), and that is, that the *real surface of resistance* at the bow of a ship is never the *bow itself*, but a certain mass of water which is carried along before the ship, and at rest relative to it. Thus if AB, AC, represent the bows, the real surface of resistance is a convex shaded mass of water, such as ADB or AEC.



This fact is easily proved—if a piece of wood, or any floating substance, be dropped from the bowsprit it will, as soon as it gets into this quiescent water remain there at a certain distance from the ship, and be carried along with it.

A great many of the discussions on the

Digitized by Google

best form of bow are rendered perfectly futile from neglecting this consideration.

A. H.

P. S.—In the paper of mine contained in No. 1248, there is a singular transposition of a paragraph from one column to another, which the reader will have the goodness to correct.—Page 32, transfer the paragraph beginning "As $Q_1 \times S_1$," &c., line 26, from column 1 to complete the sentence at the bottom of the second column, thus "$P_1 dx +$ &c. is equivalent to such a series as $Q_1 \times S_1 + Q_2 \times S_2 +$ &c."*

WALKER'S HYDRAULIC ENGINE.

On Thursday (July 8th) a public trial was made with Mr. Walker's Patent Hydraulic Engine, being the first one completed for a large estate at British Guiana in the West Indies. The engine had been erected in a capacious sunken tank at Mr. Walker's premises in the Wharf-road, City-road. The machine consists of two steam cylinders and two water cylinders or pumps, placed vertically beneath them; a crank shaft connects the two steam pistons, and carries a fly-wheel between them. From the cross heads of the steam pistons, two connecting rods pass down to the platforms upon which the water pistons are mounted. The latter work in two pump barrels, open at the bottom and terminating in a valve box at the top leading to the exit main of the engine. The valves, in the top of the barrels, as well as those in the pistons, are of a novel and ingenious construction, in some measure resembling the grid-iron valve included in Mr. Walker's former patent, only that instead of bars playing upon flat seats, the valve is formed of rolled tubes lying in half-round seatings; an arrangement which affords unexampled facility for the passage of the water, and at the same time ensures certainty of action in the valves with the smallest possible shock or jar to the machinery. The steam cylinders are each 11 inches in diameter; the water cylinders 24 inches, with a 24 inch stroke. Contrary to the action of ordinary pumps, in Mr. Walker's engine the water rises in an almost continuous stream by virtue of the momentum imparted to it by the speed of the piston; so that the ordinary rules of calculating the power of pump work is wholly inapplicable to this engine. When working with a steam pressure of 35 lbs. upon the inch, and the crank shaft making 70 revolutions per minute, six thousand gallons of water are delivered in that time, the lift being about 7 feet. By increasing the pressure of the steam, and consequently the speed of the engine, the quantity of water raised increases in a geometrical ratio. For the purpose of the present exhibition only one steam boiler was employed, but when set up in its destined place, two boilers will be employed with so large a measure of flue spaces as to effect the utmost economy of fuel. For the same purpose, Mr. Walker employs a hot-water box of an admirable construction, within which the cold water pumped up is heated by the waste steam to the boiling point, and in that state delivered to the boiler. The steam cylinders are single acting, *i. e.*, steam is admitted on the under side of the pistons only by means of a slide valve placed beneath the cylinders, and worked by an eccentric on the crank shaft. The water cylinders are sunk in a large iron well, fitted with sluices which communicate at pleasure with the water in the drains, or with the external river. The delivery-box is fitted with similar contrivances to send the water raised, out into the river, or back into the canals, so as to be equally applicable for draining, or irrigating.

A number of scientific gentlemen, West India proprietors, and persons interested in draining both at home and abroad, witnessed the performances of Mr. Walker's engine, as did also Earl Grey, Secretary of State for the Colonies; all of whom expressed their entire satisfaction with its performances, and it was admitted to be the most compact, most powerful, and most economical machine ever applied to this important purpose. The machine occupies a space of less than 4 feet square. Machines of less power, and destitute of many of the improvements which contribute to the efficiency of the present one, have been for sometime employed with the best results by the Commissioners for draining in Somersetshire, Norfolk, and in Lincolnshire. In

* The "transposition" referred to arose from our friend having inadvertently mis-paged his manuscript, marking page 4 as page 3. The printer saw there was some incongruity, but thought himself bound, as all printers do, "to follow copy;" and the Editor, whose more special duty it is to see to the sense or readableness of what is published under his sanction, was absent from England during the passage of the last number through the press.—Ed. M. M.

Digitized by Google

the county of Norfolk, a large tract of land is at this time growing the finest corn, which has never before been cultivated, owing to the impossibility of properly draining it by the means heretofore employed for that purpose.

The West India proprietors have expressed a deep interest in the success of Mr. Walker's invention, as it will enable them to avert the only serious evils they have now to contend with—alternately floods and drought.

The simplicity of the machine is such, that it can be set up, and at work within a week of its arrival, and may be driven by a labourer or ploughboy.

A second machine is in the course of erection for trial at Mr. Walker's wharf.

REV. T. P. KIRKMAN'S REPLY TO W. S. B. WOOLHOUSE, ESQ.

Sir,—I beg your permission to offer my best thanks to Mr. Woolhouse, for the very kind and courteous manner in which he has done me the honour to reply, in No. 1248, to my remark at p. 604 of your last volume.

I am content that any of your readers should think, as Mr. Woolhouse thinks, that the restriction which my demonstration imposes upon the enunciation of the theorem proposed as the Prize Question for 1845, required no acknowledgment; at the same time, no one will, I trust, incur his displeasure, who may conceive that the sums of quantities compared in that enunciation are to be considered arithmetical, without reservation for algebraical changes of signs; and that a line of distinct notice was fairly due to those correspondents who supplied the requisite correction of the theorem.

Upon reconsideration of the remark that I have diffidently offered, p. 608, upon the Prize Question for 1846, I find, and I here acknowledge that my *reductio ad absurdum* is itself absurd, and that the answer which I ventured to substitute is, as Mr. Woolhouse affirms, undoubtedly incorrect. The confusion of my ideas arose not, as Mr. Woolhouse naturally conceives, from my neglecting to observe the vertical force F sin θ, but from my observing it but too well. Seeing that, at each of the points of contact between the spheres, there is an equal and opposite force exerted, $-$F sin θ, (equation (1) and (2)); then applying the rule of addition, and attempting too far to simplify my conceptions, I dismissed all regard to the vertical effect of friction, and demanded an account of the downward pressure 4W. I thus landed again and again in the difficulty that I have stated—I hope with sufficient modesty. Many, vastly my superiors in science, will perhaps sympathise with an embarrassment arising from my unwillingness to trust everything to the magic symbols of a general method, even when I saw that the resulting equations were unassailable by direct reasoning.

I hope that the gentlemen whose names are appended to the solution in question, will readily find, in the deferential form, employed by me, all the apology which would otherwise have been so justly their due.

T. P. K.

Croft Rectory, Warrington.
July 14, 1847.

THREE-CYLINDER ENGINES.

Dear Sir,—In the last part of your Magazine (p. 556) are some observations by "J. H." on the late accident on the South Coast Railway; and, in order to avoid the oscillations of the engine, which he considers to have been the cause of the accident, he proposes to have a third cylinder added, and seems to say that the idea is quite original, as the engine which had run off the rails was one of "Stephenson's LAST patent."

Your correspondent seems not to be aware that Mr. Stephenson has constructed an engine some time ago, embodying the improvement he names, namely, having two cylinders placed on the outside, and a third one, "of the united area of the outer ones, placed between," for the express purpose of hindering such oscillations of the engine. I am not aware whether a patent has been procured for it; but the "new idea" must be due to Mr. Stephenson, and not to "J. H.:" and the engine which caused the late accident is not the *latest*.

I am, Sir, yours, &c.,
A SUBSCRIBER.

DECIMAL NOTATION.

Sir,—In reply to "W. R.," respecting the method of writing money amounts, published in No. 1246, I beg to say, that the horizontal line placed above a figure is instead of the unit which is prefixed to it in the ordinary method. I thought this would have been apparent from the example, without occupying your columns with an explanation—as it was stated the object was to save space, and not to facilitate computation.

I do not believe the new way would be attended by more errors than the old. A

Digitized by Google

person who would omit the horizontal line, would omit the unit; and it must be placed very carelessly, to appear doubtful which of two figures it belongs to: this error is also very improbable from there being but two amounts of pence, viz. 10d. and 11d., with which it could be made.

I am, Sir, yours, &c., W. O.

Islington.

BARON VON RATHEN'S COMPRESSED AIR LOCOMOTIVE.

In our journal of the 12th of June, we made mention of some experiments which we had the pleasure of witnessing at the College for Civil Engineers, Putney; which had for their object, to test the practicability of Baron Von Rathen's new plan (patented, but still unspecified) of working locomotive engines by compressed air. We stated, that we had seen on that occasion air compressed to upwards of 850 lbs. per square inch, and this enormous power set free again with the greatest facility for locomotive purposes—that is to say, not all applied at once, but "set free," or let off, as wanted, in quantities proportionate to the work performed. We noticed further, that there was a common-road locomotive in the course of building at the workshops of the college, which was intended to be worked on this plan. Since then some additional experiments have been exhibited by Baron Von Rathen; for the following particulars of which we are indebted to an eye-witness:

On the 8th instant the compressed air reservoir was again charged to upwards of 800 lbs. per square inch, in the presence of a number of gentlemen who have associated to make trial of the Baron's system, and if that trial prove successful (of which there seems now every probability), to promote its general adoption on railways and common roads; and, in order to show the perfect control under which this prodigious force is kept, and the ease with which it may be applied, in more or less abundance, the air was allowed to escape from the reservoir, at intervals regulated solely by the pleasure of the persons superintending the experiment. The noise made by these successive escapes of air was like that of a battery of cannon. Another point which remained to be practically demonstrated was, the length of time which the reservoir was capable of retaining a body of air under so high a state of compression; and in that respect also the result was in the highest degree satisfactory. Four days after the experiment just described, the reservoir was again tried, in the presence of the Duke of Buccleugh (the enlightened and public-spirited patron of the college) and several other noblemen and gentlemen—being still in the same state in which it was left on the 8th instant, and reduced only in its original force by the amount of air discharged from it on that occasion. The working power of the apparatus was now found to be, for all practical purposes, in as high a state of perfection as ever, the air issuing with apparently undiminished elasticity from its state of confinement, and with a noise which could only be likened, as before, to that of heavy artillery. Of no other motive power yet invented can it be said that it is capable, like this, of being stored up in any quantities, not only till the occasion arrives for its use, but in a state always fit for instant use; stored up, moreover, in vessels which may be either stationary or carried about from place to place. Of no other known power, either, can it be said, with so much truth, that it is unlimited in its source, and free from everything like nuisance in its application.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 599, VOL. XLVI.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

John Davis, of Long Acre, coachmaker: of a new method of hanging coaches, vis-à-vis, and other bodies, so that, in case the carriage should be overturned, the body will remain upright and free from the ground. Cl. R., 27 Geo. 3, p. 7, No. 6. Aug. 11, 27 Geo. 3; Sept. 7, 27 Geo. 3, 1787.

Thomas Mitchell, writer, of Perth: of a new method of raising water and other fluids, for the purpose of driving mills and other machines, and watering lands. Also for draining lands, and pumping or clearing water from ships, and for extinguishing fires in houses, and other useful purposes. Cl. R., 27 Geo. 3, p. 7, No. 3. Aug. 28 last; Sept. 26, 27 Geo. 3, 1787.

Samuel Hooper, of the parish of St. Giles-in-the-Fields, bookseller and stationer: of a new method of making or manufacturing printing paper, particularly for copper-plate printing. Cl. R., 27 Geo. 3, p. 7, No. 1. Sept. 17, 27 Geo. 3; Oct. 17, 1787.

John Shankster, of Great Pulteney-street, Westminster, oval turner: of a new method of hanging of coaches, chariots, phaetons, calashes, gigs, chaises, and other carriages, whereby the lives and limbs of her majesty's subjects, to be conveyed therein and thereby, are rendered more safe and secure than in or by any other carriage heretofore made, built, and hung, for the carriage or conveyance of

Digitized by Google

persons travelling and otherwise conveyed thereby. Cl. R., 27 Geo. 3, p. 8, No. 3. Oct. 6 last; Nov. 6, 28 Geo. 3, 1787.

John Collinge, of Bridge Road, Lambeth, cabinet-maker: of an improvement in making of carriage and other wheel boxes and axle-trees, which will be more durable and less liable to be out of order than any now in use. Cl. R., 27 Geo. 3, p. 8, No. 1. Nov. 2, 1787; Dec. 1, 28 Geo. 3, 1787.

Thomas Mead, of Sandwich, carpenter: of an invention of a regulator on a new principle for wind and other mills, for the better and more regular furling and unfurling the sails on windmills without the constant attendance of a man, and for grinding corn and other grain, and dressing of flour and meal superior in quality to the present practice, and for regulating all kind of machinery where the first power is unequal. Cl. R., 27 Geo. 3, p. 14, No. 1. Nov. 15, 28 Geo. 3; Dec. 14, 1787.

Thomas Henderson, of York, stucco plaisterer: of an instrument (discovered by the specifier's father, and by him imparted) by which every visible object may be drawn and taken to any size, on true mathematical principles, with great accuracy and facility. Cl. R., 27 Geo. 3, p. 15, No. 19. Dec. 19, 27 Geo. 3; Jan. 6, 1787, 27 Geo. 3.

John Garnett, of Redland, Gloucester, merchant: of a method of greatly reducing the friction of an axis or fulcrum, useful for all axles, wheels, beams, levers, pendulums, blocks, pulleys, and other instruments that have a partial, total, or repeated revolution or oscillation. Cl. R., 27 Geo. 3, p. 15, No. 3. Jan. 6 last; Feb. 26, 27 Geo. 3, 1787.

Richard Heaton, of Chevat, near Wakefield, farmer: of a drill harrow which sows and harrows at the same time, and which is on an entire new construction; for the sowing of all kinds of grain, turnip, rape seed, &c., and any quantity of any kind of seeds with the greatest regularity upon an acre, and the rows at any distance from 6 to 36 inches; it soweth without bruising the seed, or any difference in the quantity of seed either up hill or down; and as the quality of land frequently differs in the same close, the person that holds the machine may vary it at pleasure to suit the land as he crosses or goes up or down the close without standing to alter it; it soweth ridged lands of any size with the same propriety and expedition as level, it also makes drills in any kind of lay or strong land; it soweth brin'd and hin'd wheat and long oats with as great propriety as other corn; it soweth hand tillage (that is rape-dust, pigeon-dung, &c. if required) either in the drill with the corn, or on each side, or both; it marks the place where the horse is to go, so that the rows stand regularly, and the work may be performed with one horse. Cl. R., 27 Geo. 3, p. 16, No. 1. March 10, 27 Geo. 3; March 31, 27 Geo. 3, 1787.

Insulation of Telegraphic Signal Posts.—Mr. Ira Cornell, of Ithica, N. Y., is the inventor of a beautiful and efficient contrivance for insulating the wires on telegraphic posts. By this invention the fluid can never be carried to the earth in wet weather, as is frequently the case to the great annoyance of the operation. The contrivance consists in giving to the lower part of the glass knob a bell-shape, and this resting on the wooden pin, so that the underside will always be perfectly dry. Another plan, by the same inventor, to effect this object consists in an *iron* knob similarly shaped, but lined on the under side with glass, and a glass bush to pass the wire through; this latter knob cannot be very easily broken by stones being thrown at it. The knob has been introduced with perfect success on the Buffalo line, where communications of five hundred miles are as certainly and easily carried as if across the street. *Eureka.*

LIST OF ENGLISH PATENTS GRANTED ON JULY 17, TO JULY 23, 1847.

William Hensman, of Woburn, Bedfordshire, for certain improvements in thrashing machines. July 17; six months.

Pierre Armand Lecomte de Fontainemoreau, of 4, South-street, Finsbury, for certain improvements in machinery for preparing cotton and other fibrous substances. July 17; six months.

Henry Bessemer, of Baxter House, Old-street, St. Pancras-road, Middlesex, engineer, for improvements in the manufacture of plates, sheets, or panes of glass. July 17; six months.

William S. Henson, of London, for certain improvements in the construction of razors for shaving. July 17; six months.

Robert William Sievier, of Henrietta-street, Cavendish-square, Middlesex, gentleman, for certain improvements in stamping, marking, cutting, embossing, or printing. July 17; six months.

John Sykes and Adam Ogden, both of Huddersfield, York, for improvements in machinery for cleaning wool, cotton, and similar fibrous substances from burs, motes, and other extraneous matter. July 17; six months.

James Whitley, of Botany, Bingley, Yorkshire, for certain improvements in the mode of washing, scouring, and dying of wool, alpaca, mohair, cotton, and other fibrous substances. July 19; six months.

Edward Light, of Esther-terrace, Bermondsey, master mariner, for improvements in apparatus for supporting or buoying up persons, boats, and other bodies when in the water. July 19; six months.

Joseph Tall, of Bineton, Surrey, builder, for improvements in apparatus for setting saws. July 19; six months.

Edward Slaughter, of Avon-side Iron Works, Bristol, engineer, for improvements in locomotive engines. July 19; six months.

Anthony Bernhard Von Rathen, of Putney, Surrey, civil engineer, for certain universal wheels, or improved direct rotatory engines, to be worked by steam, air, or any other elastic power. July 19; six months.

Joseph Jean Baranowski, of 3, Rue Neuve Clichy, Paris, gentleman, for a ready-reckoning machine. July 19; six months.

John Lewthwaite, of Halifax, York, gentleman, for certain improvements in numbering-machines. July 23; six months.

Harry Joseph Perlback, of Hamburgh, founder, for an improved method or methods of uniting certain metals and alloys of metals. July 23; six months.

Henry Samuel Rayner, of Ripley, Derby, civil engineer, for certain improvements in propelling on land and water. July 23; six months.

Digitized by Google

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
July 15	1134	William George Bentley	High Holborn	Anti-evaporation blacking apparatus.
17	1135	A. & M. Burton	Holland-street, Blackfriars	Effluvium flap, or valve, for drains.
„	1136	Welch, Margetson, and Co.	Cheapside, London	Elastic mourning band.
„	1137	James Thornton	Waterford, architect	Improved jaunting car.
„	1138	Samuel Messenger	Birmingham	Railway carriage roof lamp.
„	1139	Barrett, Exall, and Andrews	Reading, Berkshire	Feed gear to chaff cutters.
19	1140	William Hyatt	Plummer-street, City-road	Apparatus for regulating the supply of water to the condensers of steam engines.
„	1141	James Milne & Son	Edinburgh, brass-founders, &c.	Improvement in gas-meters.
20	1142	James Davis	King-street, Frome, Somersetshire	Balanced valve gulley trap, to prevent the ascent of noxious vapours from sewers and drains.
„	1143	Keith Imray, M.D.	Devonshire-street, Portland-place, London	Pessary for the relief of prolapsus uteri, or prolapsus ani.
21	1144	John William Phelps	Cheapside	Spiral abdominal supporter for prolapsus uteri.

Advertisements.

TO MINE AND COLLIERY PROPRIETORS, SLATE QUARRY OWNERS, RAILWAY CONTRACTORS, IRONMONGERS, DEALERS IN GUNPOWDER, AND OTHERS.

MESSRS. JOHN HALL AND SON, THE PATENTEES AND SOLE MANUFACTURERS OF

SCHONBEIN'S PATENT GUN-COTTON,

Respectfully state, that they are now prepared to SUPPLY the PATENT GUN-COTTON (compressed for the convenience of carriage), in round and square paper cases, of 4 ozs. each, packed in boxes, containing 50 and 100 cases each, at the price of 3s. per lb., for ready money.

Also, in tubes or cartridges of... 1, 1½, 1¾, and 1⅞ inch diameter;
Containing ..... 2, 4, 6, and 8 ounces each, at the
Additional charge of..... 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 3 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

Office, 23, *Lombard-street*, *London*.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are, that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

Spence on the Specification of a Patent.

This day is published in 8vo., price 7s. 6d., boards.

A TREATISE on the Principles relating to the Specification of a Patent for Invention; showing the standard by which the sufficiency of that instrument is to be tried.

By William Spence, Assoc. Inst. C.E., Patent Agent.

London: Stevens and Norton, 26, Bell-yard, Lincoln's-Inn, and 194, Fleet-street.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

Just Published,

In 4to., price 12s. 6d., in limp cloth; or 15s. bound in flexible leather,

EARTHWORK TABLES, for Railways, and other Public Works. By CHARLES K. SIBLEY, Civil Engineer, and WILLIAM RUTHERFORD, of the Royal Military Academy, Woolwich.

*** These Tables are calculated for various slopes, and to central widths, for every foot, from 23 feet to 43 feet. Their object is to furnish at a glance results which require considerable calculation with tables at present in use. They are computed to show the *total* content for one chain in length, with heights at each end from 0 to 60 feet, at intervals of half a foot. No multiplication is necessary.

London: Longman, Brown, Green, and Longmans.

CONTENTS OF THIS NUMBER.

Bain's New System of Electro-Telegraphic Communication.—The Specification, Verbatim, Concluded—(*with engravings*) 73

American Patent Law Case.—Smith and Sloat *v.* Mercer and Pechin.—Planing, Tongueing, and Grooving Machinery 79

Explosion of an American Locomotive.—Report of a Committee of the Franklin Institute on the Causes of the Accident—(*with engraving*) 84

The Centurion Papers.—No. II. Election Manœuvres Algebraically Investigated 88

An old French Experiment in Shipbuilding..... 90

Walker's Hydraulic Engine—Important Experiments 91

Rev. T. P. Kirkman's Reply to Professor Woolhouse 92

Three-Cylinder Engines .....

Decimal Notation..... 92

Baron Von Rathen's Compressed-Air Locomotive—Further Experiments 93

Calendar of Specifications—(*continued*)..... 93

Insulation of Telegraphic Signal Posts 94

Weekly List of New English Patents. 94

Weekly List of Articles of Utility Registered... 95

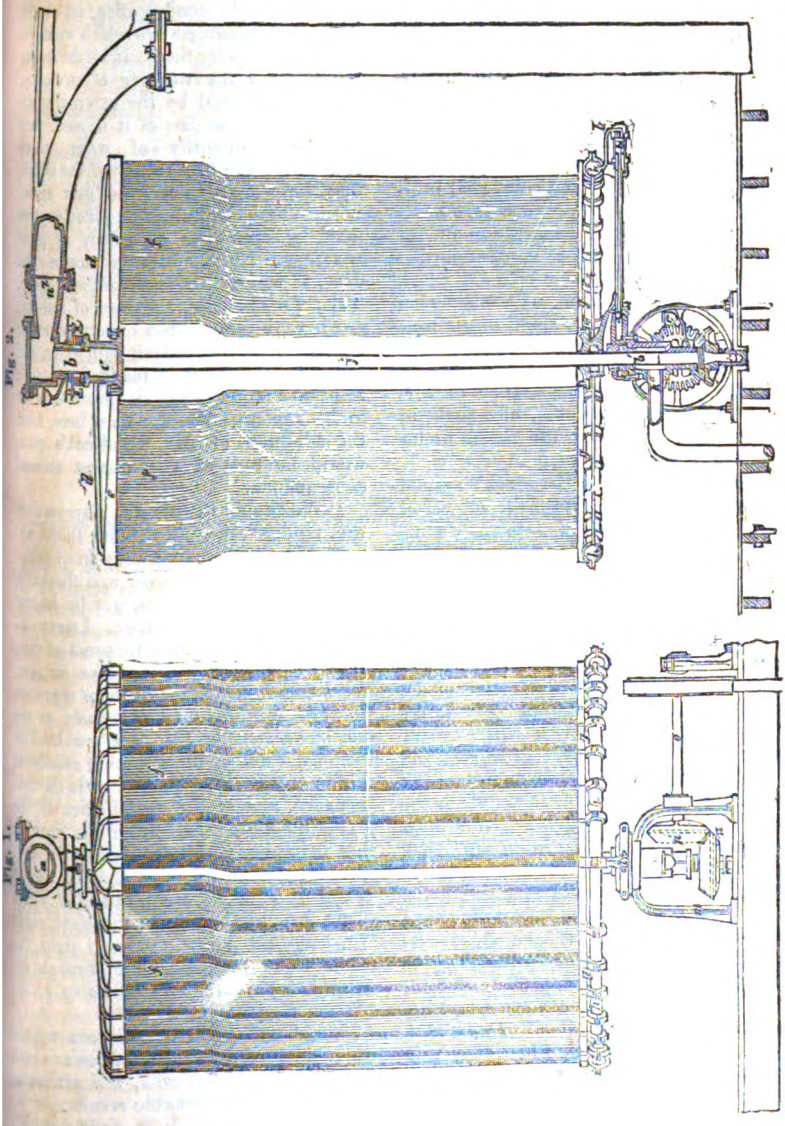
Advertisements 95

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.
No. 1251.] SATURDAY, JULY 31. [Price 3d.
Edited by J. C. Robertson, 166 Fleet-street.

CRADDOCK'S STEAM-ENGINE CONDENSER.



Digitized by Google

CRADDOCK'S STEAM-ENGINE CONDENSER.

[Patent dated December 3rd, 1846. Specification enrolled June 3rd, 1847.]

THE name of Mr. Craddock, as an improver of the steam-engine, is not unknown to our readers. In 1840 he took out a patent for improvements in "steam engines and steam boilers," the nature of which was fully described in several communications, from Mr. Craddock himself, inserted in this journal, vol. XXXVI, p. 246, and vol. XXXVIII, pp. 177, 245, 516. Since then, Mr. Craddock appears to have been assiduously engaged in improving and perfecting his original plans; and this has led to a second patent, the specification of which—a very long, and somewhat multifarious document—is now before us.

It may be in the recollection of our readers, that the most prominent portion of Mr. Craddock's inventions, was a new method of condensation, by the external application of cold air; and in the present specification this also holds a foremost place. We propose this week to confine ourselves to this branch of Mr. Craddock's improvements, and shall, in future numbers, bring the others under the notice of our readers.

The merits of Mr. Craddock's system of condensation have been the subject of a good deal of discussion,—more distinguished, we regret to say, for carping illiberality and disingenuous misrepresentation, than for truth and candour. He has been represented as putting forward his air method as superior to the ordinary method of condensation by water; whereas he has again and again stated most emphatically, that he only offers his method for adoption where water cannot be had, or only at great cost and inconvenience. We quote an instance or two: "I cannot say it is so simple as the injection (water) condenser; *this must stand in point of simplicity without a rival;* but simplicity may be too dearly bought when it entails practical evils, and stops short of the fullest development of the utility of the steam-engine:" *Chemistry of the Steam-Engine Practically Considered*, p. 63.* Again, "*I do not propose to condense with air where water is obtainable*," *Ibid.* p. 72. And to the same effect, when adverting to an implied charge of seeking to supersede the Cornish engines which are used "where water is plentiful," he observes, "*Let it be clearly understood that I propose no such thing*," *Ibid.* p. 73.

Keeping in mind, therefore, what the real scope is of Mr. Craddock's improvements in condensation, let us see what the advantages are which would be gained by its adoption. If all the steam, required for the working of an engine, can be condensed by the external application of air, as fast as it is used, then the same quantity of water, which suffices for the first supply of the boiler, may be worked over and over again, with but small diminution; and engines may be employed to nearly as great advantage where water is scarce and dear, as where it is abundant and cheap. Take, for example, the case of railways—where the engine has to carry a tender along with it to supply it with water, and must, as often as that tender is emptied, come to a stop in its swift career, in order to be replenished—the gain here, from the adoption of Mr. Craddock's plan, would be one of the utmost national consequence:

"We should in this way dispense with the tender altogether; nor should we want any more than a very small quantity of water, if any, over and above that contained in the boilers, *for the longest journey England presents*. I may mention, as an illustration in proof of this, *that I once worked an engine for four weeks, without the addition of any water to that contained in the boiler at the commencement of the experiment*. The boiler was one of the common cylindrical kind: it was three parts full in the first instance, and at the termination of the experiment was half full; the quantity lost being equal to four gallons per day. It will at once be seen that no loss of water can take place, but that which leaks through the joints; therefore, could we keep our joints perfectly tight, the same water may circulate through the engine for years."—*Chemistry of the Steam Engine*, p. 78.

Mr. Craddock enters into a minute calculation of the saving of power which would be thus effected, and arrives at the following remarkable results:

"With the evaporation of 120 cubic feet of water in the present locomotive, 133-

* Simpkin and Co., 92 pp., 8vo.

Digitized by Google

Fig. 4.

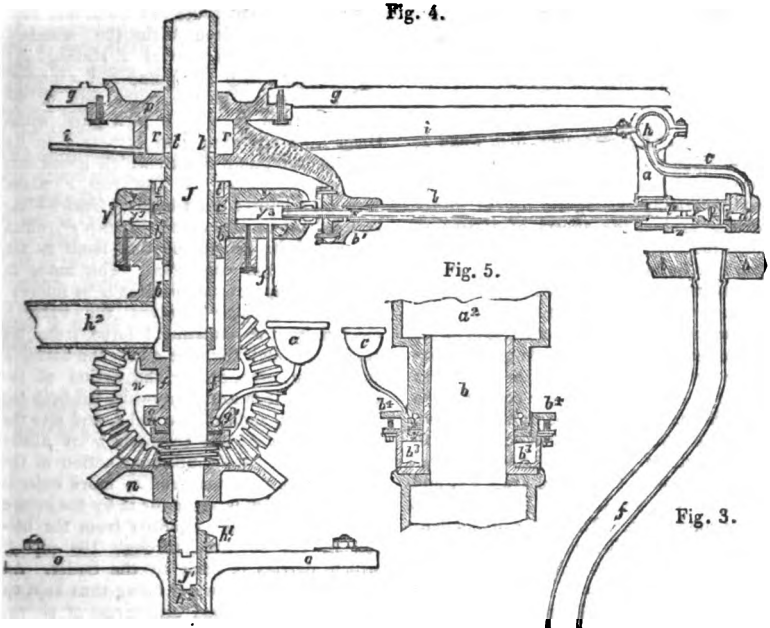
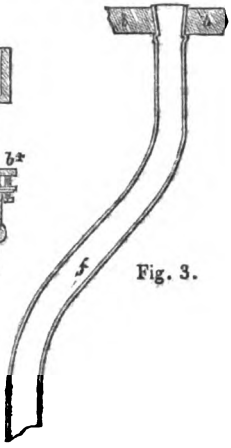


Fig. 5.

Fig. 3.



horse power gross is obtainable. We know that the jet or blast requires power equal to 20-horse, and that the resistance induced by the engine and tender is equal to 23-horse power. I have said that my system would dispense with the jet, and also with the tender; and I may add that, if desirable, the engine itself need not be by 4 tons as heavy as those now used for the same power. We next find that the resistance induced by the engine and its appendages would be reduced from 43 to 11-horse power. Is it asked how this is to be effected? I have anticipated the answer in part, and shall only observe here, that we get rid of the resistance of the blast by not requiring the wasteful expenditure of steam, which has led to its adoption. We shall be able to dispense with the tender, by requiring no additional supply of water over and above that contained in the boiler; and, I firmly believe, we should not require above one-quarter the quantity of coke for the production of the same power. The necessity, on the present system, for such an immense volume of steam per minute, requires great weight in the boiler; but, on the removal of that necessity, will follow the reduced weight of the engine.

"If we render 32-horse power available for the purpose of propelling the train, which now is consumed by the jet, and the extra resistance from the tender, &c., noting the increased power produced from a given weight of steam, with the atmosphere removed, or a vacuum of only 10 lbs., we find that such a vacuum of 10 lbs. would, of itself, give us 35-horse power—to which add the 32-horse power we have seen is rendered available by the other diminished resistance. We have then reduced the quantity of water requisite to be evaporated, from 120 cubic feet to 54 cubic feet per hour. But hitherto we have taken no account of the economy consequent on expansion, which would certainly, with steam generated at 115 lbs. per square inch, further reduce the quantity of water required to 40 cubic feet. Pambour has shown, that only $\frac{76}{100}$ths of the water that passes through the locomotive engine is really converted into steam; so that the quantity of steam to be condensed, to propel a train, such as we have been describing, would not exceed that which can be produced from 33 cubic feet of water. A condenser which would effect the condensation of this quantity of steam per hour, would not be above 30 cwt., and would occupy a circular space of about 5 feet diameter by 7 feet high, or would not stand above the framing of the engine more than 5 feet."

Digitized by Google

We now proceed to extract from Mr. Craddock's specification his description of the improved arrangements by which these important ends are to be accomplished:

The body of the condenser, figs. 1 and 2, is of a circular form, and composed of small tubes *f f*, all uniformly curved (as shown separately in figure 3), in order to provide against the effects of expansion and contraction, and inserted at top and bottom into hollow arms *e e* and *g g*, which radiate from a hollow central shaft *j*, on which the condenser is made to revolve, or otherwise move, as afterwards explained. The exhaust-pipe a^2, of the large or low-pressure cylinder a^1, conveys the steam to a receiver *c*, on the top of the condenser to which it is connected by a joint *b*, as shown separately on an enlarged scale on figure 5. From *c* the steam passes off through diverging pipes *d d*, into the radial arms *e e*, and thence into the small pipes *f f*, where it becomes condensed. The water of condensation collects in the under radial arms *g g*, and passes thence into a ring *h h*, from which it is conveyed away by pipes *i i* (see fig. 4), into a central annular chamber *v v*, from which there are openings at *t t* into the central hollow shaft *j*. From *j* the water passes into another annular chamber *b*, from which it is conveyed back by the pipe k^2, to the air-pump; *n* Figure 2 is a mitre wheel keyed to the bottom of the central shaft *j*; n^1, another mitre wheel which works into *n*, and is supported by a bracket *m*, having at the outer end of its shaft *o* a pulley n^2, which is connected by a band and pulley *p*, with the axis of the fly wheel. When the rotary motion given to the condenser by means of these wheels and pulleys is not considerable, the air-pump (which communicates with the condensers through the medium of the parts k^2 *b r j* and *i i*) effects as perfect an exhaustion of the condenser as need be, but when the motion becomes rapid, centrifugal force is generated, which has a tendency to retain the water in the circular ring *h*; and to provide against this the following contrivance is adopted:—*y* is a fixed eccentric, in which the central shaft *j* revolves, and *z* is a small horizontal pump pendent by a link *a* from the ring *h*; the eccentric *y* and pump *z* are connected together by a hollow rod *x*, which is at one end attached to the pump bucket *e*, and at the other to the eccentric clip y^2, terminating in a hollow space y^3, in the body of that eccentric; *l* is an outer tube which encloses the hollow pump-rod *x* and communicates by an aperture at l^2 with the hollow rod *x*; *u* is a bracket projected from, and cast in the same piece with the annular-chamber *r*, which carries a stuffing-box b^1, through which the pump-rod *x* passes, and also supports the inner end of the external tube *l*; and *c* is a pipe which leads from the ring *h* to a valve *d* in the head of the pump barrel, which opens into the pump bucket *e*. The rod *x* passes through a jointed cross-head x^2, before being screwed on to the eccentric clip y^2, which allows of its accommodating itself to the motion of the eccentric. The mode in which the apparatus operates is as follows: As the condenser revolves the water is ejected by the centrifugal force from the ring *h*, through the pipe *c* into the barrel of the pump, whence, by the action of the pump-rod, it is drawn inwards, till both the inner rod *x*, and external rod *l*, and also the hollow space in the eccentric *y* are filled; and when, by the continuing action of the eccentric on the pump-rod *x*, more water is drawn in, room is made for it by the escape of a corresponding quantity from the hollow in the eccentric through the pipe *f*, which carries it back to the boiler. An unceasing flow of water being thus kept up from the ring *g*, and all ingress of air excluded, the retaining tendency of the centrifugal motion is thus completely neutralized.

The manner in which the tubes of the condenser are secured at their ends into the radial arms *e e* and *g g* is peculiar. The holes are made in the arms at casting, and afterwards drilled out and tinned. The tubes are also formed at each end, and are secured in the manner shown at *b b* in figure 3, that is, with a bulge on the inside and a turn over or burr on the outside. When each arm has had all its tubes thus let in, it is dipped into a vessel of melted tin, by which every joint is made perfectly air-tight and durable. Any strain which might arise from contraction or expansion is prevented by the curved form given to the pipes.

Some other minor details connected with the condenser and anti-centrifugal pump, will be found given in the drawings, figures 3, 4, and 5, and may here be briefly described. And first, as regards the riveting joint *b*, which connects the exhaust pipe *a* with the receiver *c* at the top of the condenser, the following particulars are observable. To its bottom flange there is screwed a circular crutch b^3, within which there is a second crutch b^4, upon the inner step of which the brasses *v v*, washer (of vulganized caoutchouc) *w*, and coiled spring *x* rest.

The two outer steps of the crutches are connected together by binding screws, so

Digitized by Google

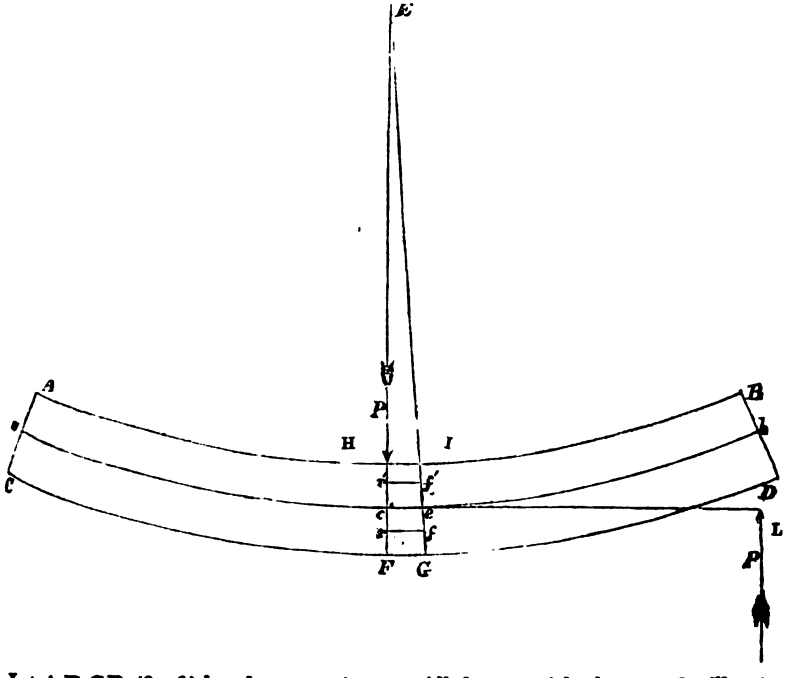
that in proportion as these screws are tightened, the under step of the crutch b^4 is pressed up against the spring x. The moving parts are lubricated from an oil cup c, the pipe of which is carried through the solid of the turned-down end of the exhaust pipe a, and which, of course, is stationary.

The radial arms g g (fig. 4), at the bottom of the condenser, are screwed into a solid piece p and o, fixed to the central shaft j, out of which piece the annular chamber r, before mentioned, is cut. The excentric y is bolted to the solid piece f, which is bored out to receive the central shaft j; c^1, c^1 is a ring which revolves within the eccentric, and moves on the top surface of a solid brass busk b^1, which is also bored out to receive the shaft j. A washer of vulcanized caoutchouc is let into a recess e^1 in the ring c^1. The brasses g^1 have a vulcanized caoutchouc-washer interposed between them, and are kept up to their places by a coiled spring s^2. J^1 is the step and false toe of the bottom of the shaft, and h^1 is a nut that screws on to the brass h^2, and by which the entire shaft can be raised or lowered as much as may be required: o o is the foundation-plate.

(To be continued.)

IRON BRIDGES.—INVESTIGATION OF THE STRENGTH OF CAST-IRON BEAMS OR GIRDERS EMPLOYED IN THE CONSTRUCTION OF BRIDGES. BY WILLIAM DREDGE, ESQ., C. E.

Fig. 1.



Let A B C D (fig. 1) be a beam or girder resting on abutments at C and D; and suppose it to be acted on by the single pressure P, applied in a line perpendicular to its original position, which, by reason of its action, produces a deflection, as shown in fig. 1.

Draw the line E F, in a line with the pressure P, and intersecting the neutral axis $a\,c\,b$ in the point c.

All the materials above $a\,c\,b$ will resist the action of the weights by compression; and all the fibres below will be excited tensionally, wherefore the line $a\,c\,b$, which is situated between these forces, will be neither extended nor compressed; and hence it will be round the point c in this line that the broken ends would turn if the beam were fractured by the force P.

Digitized by Google

From the point c set off a very small space, ce, to represent the length of a fibre, as measured on the neutral axis, and from e perpendicular to the curve acb draw the line Ge IE, meeting the line Fc HE in E.

Now, since ce represents the length of a fibre in its natural state, and G E is drawn perpendicular to the curve, it follows, from the above supposition, that F G will be the length of a similar and parallel fibre when extended, and F G − ce = the amount of extension of it. For this reason also, H I will be the length of a compressed fibre on the upper edge of the beam, and ce − H I = the extreme reduction in length by compression.

Let M = the modulus of elasticity, d = the depth of beam, d_1 = Hc, d_2 = c I, and the angle e E $c = \phi$. Also let the radius e E = R, and any variable distance cr or $cr' = x$; then

$r'f' - ce = (R + x) \tan \phi - R \tan \phi = x \tan \phi$ = the extension of $r'f'$ at the distance x from the neutral axis.

Since the extension of similar bodies is always considered proportional to the pressure, and inversely as the section of the bodies, we shall have—since M represents the force necessary to elongate a bar of iron to twice its natural length, considering it to retain an uniform section of one unit throughout the extension—

$$\therefore R \tan \phi : x \tan \phi :: M : \frac{Mx}{R} =$$

the force necessary to produce the elongation of $x \tan \phi$ in the fibre rf, and consequently

$$\therefore x : d_1 :: \frac{Mx}{R} : \frac{Md_1}{R} = T \ldots\ldots (1)$$

Which represents the amount of tension on the lower fibre FG.

Therefore, if T equal the tension on the lower surface of the beam,

$$\frac{Mx}{R} = \frac{Tx}{d_1} =$$

the tension on the fibre $r.f.$ at the distance x from the point c.

Similarly, if C = the compression on the upper surface

$$\frac{Cx}{d_2} =$$

the compression on the fibre $r'f'$ at the distance x above c.

But, in the event of rupture, the fractured ends would turn round the point c; therefore, on the principle of the equality of moments, it is to this point that the effects of all the forces, which are in the beam, must be referred.

From c draw the line cL perpendicular to the resolved force of P on the abutment D. Let P_1 = this resolved force, and write p for cL.

The effects of the force $\frac{Tx}{d_1}$ acting round c at the perpendicular distance x is $\frac{Tx}{d_1}.x$, and the effect of $\frac{Cx}{d_2}$ is $= \frac{Cx}{d_2}.x$. Now the sum of the effects of the whole of the forces between cF and cH must be equal to the moment of the resolved pressure P_1. Hence, putting b = the breadth of the beam,

$$P_1 p = b\left(\int_0^{d_1} \frac{Tx^2}{d_1} + \int_0^{d_2} \frac{Cx^2}{d_2}\right)$$

But the sum of the tensile forces are equal to the sum of the compressive forces—or $Cd_2 = Td_1$; whence $C = \frac{Td_1}{d_2}$. Substituting this value for C

$$P_1 p = b\left\{\frac{T}{d_1}\int_0^{d_1} x^2 + \frac{Td_1}{d_2^2}\int_0^{d_2} x^2 + \right\} = \frac{Tb}{d_1}\left\{\frac{d_1^3}{3} + \frac{d_1^2 d_2^2}{3d_2^2}\right\}$$

$$= \frac{T}{3} bd_1 d \ldots\ldots\ldots\ldots\ldots\ldots (2).$$

It has been found by experiment that the compressive strength of cast iron is greater than its tensile power. Let it be n times greater then $C = Tn = \frac{Td_1}{d_2}$. $\therefore d_2 = \frac{d_1}{n}$ and since $(d_1 + d_2) = d$, we have $d + \frac{d_1}{n} = d$, or $d_1 = \frac{dn}{1+n}$. Whence

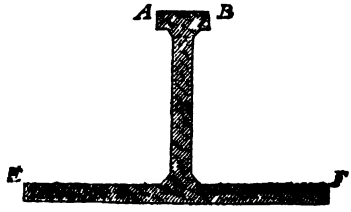
$$P_1 p = \frac{Tbd^2 n}{3(1+n)} \ldots\ldots\ldots\ldots (3).$$

Since the metal is most extended on the under surface, and compressed on its upper edge, it follows, that to have a cer-

Digitized by Google

rect section of a girder it should be made flanged; and if the metal be n times stronger on compression than on tension, the lower flange EF (fig. 2) should be n times broader than the upper flange AB, so that each may be equally strong. Fig. 2 is a section of a beam of the form which represents the assumed proportion of the upper to the lower flange as $1 : n$.

Fig. 2.



Put d_2 = the depth of the rib between the flanges, b_1 = AB, and nb_1 = EF. Then, because the metal is equally proportioned on each side of the neutral axis, we have $d_1 = d_2 = \frac{1}{2}d$. Whence,*

$$P_1 p = \delta \left\{ \int_{\frac{1}{2}d_2}^{\frac{1}{2}d} \frac{Tn}{d_1} x^2 + \int_{\frac{1}{2}d_2}^{\frac{1}{2}d} \frac{Cx^2}{d^2} \right\} = b_1 \left\{ \frac{2Tn}{d} \int_{\frac{1}{2}d_2}^{\frac{1}{2}d} x^2 + \frac{2C}{d} \int_{\frac{1}{2}d_2}^{\frac{1}{2}d} x^2 \right\}$$

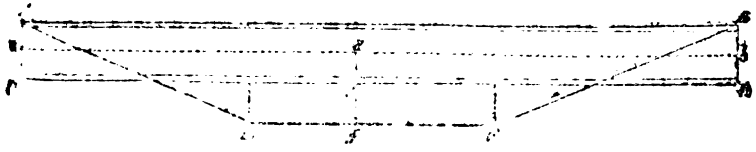
Since, by supposition, the flanges are made proportional to the strain, and the neutral axis passes up the centre of the beam $C = Tn$, whence

$$P_2 p = \frac{4b_1 Tn}{d} \int_{\frac{1}{2}d_2}^{\frac{1}{2}d} x^2 = \frac{b_1 Tn}{6d} (d^3 - d_2^3) \ldots\ldots (4)$$

is the equation exhibiting the condition of rupture.

Now, since the lower flange resists the effect of the strain by tension; and because malleable iron possesses three times the tensile power of cast iron: it follows that wrought iron would be a much better material than cast iron for the lower flange; and if tension-rods were judiciously applied, so as to relieve the strain from that portion of the beam, they would effect considerable saving in the metal of the lower flange.

Fig. 3.



Let ABCD (fig. 3) be a girder resting on D and C, and having the tension-rods attached at A and B. Put $cf = d_4$ and, in order that the position of the neutral line abc may not be altered, let the lower flange be reduced in size, so as to be exactly equal to the strength afforded by the tension-rods EF. Then if s = the section of the bar EF, and T_1 = the tension, it will resist per square unit; then $T_1 s$ = the strength of the bar EF, and $\frac{T_1 s}{2}(2d_4 + d)$ = its moment round the point c. It has been stated above that malleable iron is several times stronger than cast iron, let it be m times stronger; then $T_1 = mT$, when the moment of the tensile bar round c will be

$$\frac{Tms}{2}(2d_4 + d) \ldots\ldots\ldots\ldots\ldots\ldots (5),$$

* In this investigation I have not taken into consideration the strength of the rib between the flanges, which is considerable, and therefore any calculation founded on this investigation would be within the limits of the strength of the beam. In the experiments made by Mr. Hodgkinson, at Manchester, the strongest section of beam, the flanges were in the proportion of 1.:6.1.

Digitized by Google

which is the effective increase of the power of the lower flange. Put y = the breadth, which may be taken away from the lower flange, then

$$y\frac{b_1 T}{12\,d}(d^3-d_3^3)=\frac{Tms}{2}(e_2 d_4+d)$$

$$\therefore y=\frac{6dms(2d_4+d)}{b_1(d^3-d_3^3)}\ldots\ldots\ldots\ldots(6).$$

Whence the corrected width of the flange will be

$$b_1 n-\frac{6dms(2d_4+d)}{b_1(d^3-d_3^3)}\ldots\ldots\ldots\ldots\ldots(7),$$

Substituting this for $b_1 n$ equation (4) and reducing

$$P_1 p=\frac{T(b_1 n-\frac{6dms(2d_4+d)}{b_1(d^3-d_3^3)}}{bd}\left\{d^3-d_3^3\right\}+\frac{Tms}{2}(2d_4+d).$$

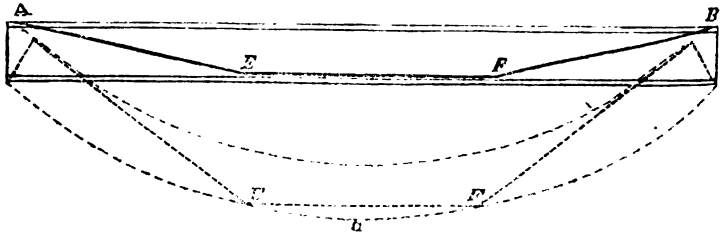
$$=\frac{T}{6b_1 d}\left\{b_1^2 n(d^3-d_3^3)-ms(2d_4+d)(6d-3b_1 d)\right\}-$$

In this investigation, I have not taken into consideration the action of the tension-rods upon the top flange, which resists a compression equal to the sum of the tension in the lower flange and tensile rods.

When the truss rods are not applied, we have seen that the amount of tension in the beam is greater than when they are applied, by reason of the portion that is resisted by the tensile bar EF, being at an increased depth (d_4) from the centre (c) to which the moments of the forces are referred. Therefore, in reality, the compression in the flange AB would be less with the rods than without them; yet it would be imprudent to economise material from this part of the beam, on account of the compression from the action of the tensile rods being throughout its whole length, from A to B; and as so long a bar, on compression, is apt to get crooked, it would be more advisable to add than to diminish from the upper flange.

It has been found by experiment, that a wrought iron bar of good material, and one square inch in section, will, under tension, extend about $\frac{1}{10000}$th of its length for every ton with which it is loaded. I am not clear upon the extension of cast iron, but it is not so great, and the limits of elasticity are much sooner passed: as the extension in both materials is always proportional to the load, and *vice versâ*. The strain is always proportional to the extension; but because under similar pressures the extensions of wrought and cast iron differ from each other, it is clear that in trussing a girder, everything should be so adjusted that the wrought and cast iron may act independently of each other. This cannot be the case if the truss is contained within the girder, and fixed to it, as in fig. 4, for the rods EF are here fastened to the points in the girder at E and F.

Fig. 4.



If the girder so trussed were deflected by the pressure p, it would be curved, as seen by the hollow lines.*

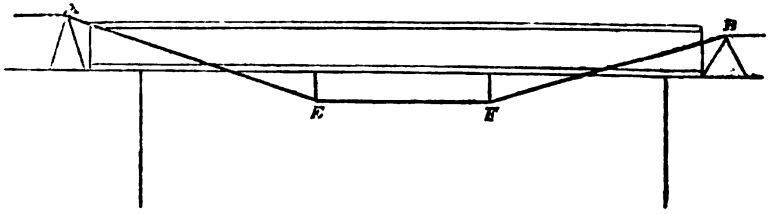
* This deflection is, of course, exaggerated.

Digitized by Google

Now since EF is attached at the end E and F, the bar would form the ordinate of the curve EaF, and consequently would not be so much extended as even the lower flange of the cast iron girder.

It would, of course, be preferable if the upper ends of the truss rods, instead of being fixed to the upper flange of the beam, were carried over cast iron saddles, A and B, on the abutment, as in fig. 5.

Fig. 5.



The props E F in the truss rods are here shown to divide the girder into three equal parts. Hence, if 2 L = the whole length of the girder $\frac{2}{3}$ L = space E F. Let μ be the load on each unit of L, then $\frac{2}{3}$ L μ = the load between each of these equal spaces, or $\frac{1}{3}$ L μ would be the resolved force on the props E and F. Hence

$$\frac{1}{3} L\mu . \frac{1}{3} L = \frac{1}{9} L^2 \mu =$$

the moment of the superincumbent weight round the central point in the neutral axis, about which (in the event of rupture) the fractured ends would turn, whereas, substituting this for $P_1 p$ in equation (4), we have

$$\frac{1}{9} L^2 \mu = \frac{T b_1 n}{6 d} \left(d^2 - d_s^2 \right) \ldots (8)$$

Which shows the girder to be nin times stronger by such an arrangemen of tensile bars than it would be withou them.*

That the girder is stronger with the tensile bars so arranged, there can be no doubt; but as the above equation is constructed on the supposition of the whole being perfectly rigid, and as in practice this would not be the case, the results, as shown by the equation, would be considerably modified. For, if $\phi = \angle$ AEa, then $\frac{2 L \mu}{3 \sin \phi}$ = the tension on the bars AE and BF, and

Thus, then, if the extension of the bar, under pressure of one such section, be $\frac{1}{10000}$th of its length, and the expression $\frac{2 L \mu}{3 \sin \phi}$ represents the strain in tons, and s = the section of the bar, then $\frac{2 L \mu}{3 s \sin \phi} . \frac{E F}{10000}$ = the extension of E F

$$\text{but } E F = \sqrt{(A a)^2 + a E^2} = \sqrt{\left(\frac{2}{3} L\right)^2 + (d + d_4)^2}$$

$$\text{when } \frac{2 L \mu}{3 s \sin \phi} \sqrt{\frac{(\frac{2}{3} L)^2 + (d + d_4)^2}{10{,}000}} + \sqrt{(\tfrac{2}{3} L)^2 + (d + d_4)^2} =$$

$$= \sqrt{(\tfrac{2}{3} L)^2 + (d + d^4)^2} \left\{ 1 + \frac{2 L \mu}{30000 s . \sin \phi} \right\} =$$

the length of the bar E F after it was extended, but,

$$E F^2 - A a^2 = a E^2$$

hence,

* Since μ = the weight on each unit of the length of the girder $\mu L = P_1$ and $L = p$—whence $P_1 p = L^2 \mu$.

Digitized by Google

$$\left\{ (\tfrac{1}{2}L)^2 + (d+d_4)^2 \right\} \left\{ 1 + \frac{2L\mu}{30{,}000\, s.\sin\phi} \right\}^2 - (\tfrac{1}{2}L)^2 =$$

$$d+d_4)^2 + ((\tfrac{1}{2}L)^2 + (d+d_4)^2) \left\{ \frac{4L\mu}{30{,}000\, s.\sin\phi} + \left(\frac{2L\mu}{30{,}000\, s.\sin\phi} \right)^2 \right\}$$

but $\left(\frac{2L\mu}{30{,}000\, s.\sin\phi} \right)^2$ is so small that it cannot possibly affect the result; whence, by omitting this, we have for the increased deflection of the bar A E, in the vertical direction c E

$$\left\{ (d+d_4)^2 + \frac{4L\mu}{30{,}000\, s.\sin\phi} \left((\tfrac{1}{2}L)^2 + (d+d_4)^2 \right) \right\}^{\frac{1}{2}} - d + d_4$$

and, consequently, would allow the girder to deflect at the points E and F to this extent, and would thereby modify the result shown by the above equations.

The conclusions we may draw from the preceding investigations are,—

1. That a girder, when judiciously trussed with tensile bars, is stronger than when not so trussed.

2. That the efficacy of the tensile bars greatly depends upon the manner in which they are applied to the girder. That the assistance they render is in proportion to their depth, or versed sine; and that their efficiency is still further increased by having the tensile bars entirely disconnected to the beam at their upper ends.

3. That in consequence of the difference of action of cast and wrought iron under such pressure considerable care should be taken, in the application of the trusses, that they should act in uniformity; and as the above equations are constructed on the supposition of perfect rigidity until the instant of rupture, calculations founded on them should be modified by the results of experiments.

AEROSTATION.

Sir,—Your correspondent, Mr. Pitter, is evidently a person of ingenuity; but he has not paid sufficient attention to the study of aeronautics. His applying the term "balloon" to the machine he has figured; is not correct, as the name, strictly speaking, is only applicable to a spherical body. To obviate an objection of this kind, the term "aerostat" was soon adopted by early aeronauts. They proposed the plan of a long, cylindrical aerostat, having conical ends; but there is the difficulty of keeping the prow pointed in the proper direction. When the machine turns the side instead of the prow to the desirable point, the cylindrical shape becomes a disadvantage. This defect has made many prefer the spherical balloon for attempts at directing.

There is a tendency of a balloon, or of a long aerostat, to turn on its vertical axis. Another difficulty is, the rapidity with which a balloon is swept to leeward by the wind, while oars or wheels, used to cause a deviation from the current, have little effect. A rudder has been found useless in attempts to steer, on account of a balloon moving as fast as the wind. A rudder of a boat in a rapid river, is of no use, while the boat moves *exactly* as fast as the stream.

It may be safely asserted, that a rudder of any kind would be of little use to keep Mr. Pitter's aerostat always pointed in the proper direction. It is in vain for him to talk of machinery, of engine-room, and engine, without giving the weight of the machinery, and a statement of the cubic quantity of gas in his aerostat, so that its lifting power may be calculated. Many who have paid aerostation much attention, have come to the conclusion that steam power is not fit for it, on account of the weight of the engine, and of the weight of the necessary fuel and water.

Condensed air is a prime mover of much force, but requires a retaining vessel of great strength, and consequently of great weight. Mr. Pitter would have his furnace to consume its own smoke; but carbonic acid gas would be given off, which would smother the aeronauts, from the way the mouth of the chimney is placed below the upper cylindrical bag.

Digitized by Google

For forcing an aerostat to any useful extent from the line of a current, a power lighter than any known is desirable. Mr. Pitter would have little faith in steam for impelling balloons, if he had read Mr. Monck Mason's "Aeronautica," or Dr. Mac Sweeny's "Essay on Aerial Navigation." Of all prime movers, man is the most powerful and effective, in every way, in proportion to his weight. *If attempts be made to impel balloons, the question, therefore, is, in what way can the power of man be employed to produce the greatest effect?*

Probably men cannot produce useful effect, in any way, with more advantage, than by the plan of warping balloons, to cause deviation from a current. This plan, which has engaged some attention of late, is looked on by many, conversant with aerostation, as giving the best chance for navigating the air.

A long aerostat has been often proposed, as the volumes of the *Mechanics' Magazine* show; but the placing of gas-bags beneath the deck on which Mr. Pitter's aeronauts are, would alter the centre of gravity of the entire machine, and would endanger its stability in an upright position. *Powder-bags are dangerous things near fire—gas-bags are not safer.*

Mr. Pitter does not appear to be aware that a parachute, in the form of an inverted cone, has been proposed before. Mr. Cocking's parachute was on this plan, and his death was the consequence of its use—as the resistance of the air tends to cause such a parachute to collapse. If, to prevent collapse, matters of strength and solidity be added, the parachute may be rendered so heavy, as to make it unfit for the safe descent of an aeronaut.

Mr. Pitter thinks, that if a cylinder for gas be very large, the machine will become unmanageable. In this opinion he differs from Sir George Cayley and other high authorities on aerostation, who say, and with just reason also, that there is the greatest chance of directing when aerostats of vast size are employed.

There is one point on which all persons will agree,—the necessity of having springs attached to the car of a balloon, to prevent a violent shock on reaching the ground when a balloon descends with rapidity. A precaution of this kind may be the means of saving lives, and should be constantly advocated, until the force of public opinion would oblige every aeronaut, in every country, to adopt so simple and efficacious a mode of insuring safety in case of a rapid descent.

I am, Sir, yours, &c.,

ARGUS.

July 15, 1847.

THE "COLLEGE OF PRECEPTORS."

Sir,—Many of my brethren have no doubt read, with as much satisfaction as I have, the strictures which have lately appeared in your Magazine, to which I have been a subscriber for many years; and we owe you an amount of thanks increased by the consideration that the subject was one which you might have passed by without any dereliction of your editorial responsibilities, and that you were led to wield your able pen in the defence of the scholastic profession, by the desire, often shown in your pages, of forwarding schemes which have, in the usefulness in view on the one hand, and on the other of exposing those which are not based on fairness and sound principles.

I have been more than once asked to join the "College of Preceptors" on the plea that it would be the means of providing us with better assistants, and would raise the schoolmasters' profession to the station it ought to hold in society; but the extreme arrogance of some of their earlier advertisements, and the conviction that neither of those ostensible purposes would be answered by a body so constituted, have ever prevented my enrolling myself in their ranks; and even the knowledge that at least one of the gentlemen, who take an active share in the management, is both a very worthy man and an excellent teacher, has failed to remove any of my objections. Mere neutrality, however, is not sufficient to arrest the progress of an undertaking which threatens no less than placing a yoke on our necks. The number of its members seems increasing: masters from the mistaken notion that they will thereby acquire a desirable status, and assistants for the sake of diplomas, bring their guineas to the capacious treasury; a charter is talked of, and if we remain absolutely passive, it is possible that a future Parliament may not consider that those schoolmasters that are not for the

Digitized by Google

college are against it. It behoves us then to be up and doing, to organize an opposition respectable in its numbers, and strenuous in its leaders, for the purpose of counteracting a mischief, which otherwise our continued supineness will assuredly allow to increase in magnitude and strength to a degree we shall have reason to regret.

To my thanks for the care you have taken, and which I trust you will continue to bestow on the subject, I should, but for the fear of being thought tedious, have added others for your papers on the "Use of Mathematical Knowledge," &c., and for the series just begun by Professor Davies: they are conceived in a truly Pestalozzian spirit, and can hardly fail to become eminently useful, not only by the positive knowledge they convey, but by thus teaching men the art of thinking.

I am, Sir, yours, &c.,
P. SANDOZ.

Twickenham, July 24, 1847.

GEOMETRY OF THE LINE AND PLANE.—BY T. S. DAVIES, F.R.S., L. & E., F.S.A., ROYAL MILITARY ACADEMY, WOOLWICH.

(Continued from p. 38.)

CHAP. II.—*Parallel Lines and Planes.*

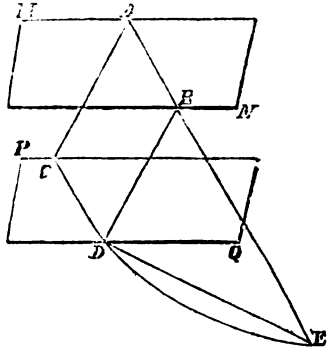
PROP. I.

If two parallel planes be cut by a third plane, the sections will be parallel.

Let the parallel planes MN, PQ be cut by the plane AD: then the lines of section AB, CD will be parallel.

For, if AB, CD which are in one plane AD be not parallel they will meet in some point, as E.

Then, since AB lies wholly in the plane MN, and CD in the plane PQ, their intersection E is in both the planes MN, PQ; and hence those planes meet in E. But they are also, by hypothesis, parallel, and hence never meet (*def.* i.). Wherefore the lines AB, CD in which the same plane AD cuts MN, PQ can never meet: that is, they are parallel.



Note.—In the figure, the line CD is continued to E, in two different ways:—by a curve, and by a line, DE, which is not continuous of CD. The latter method is always adopted in the figures of "Euclid's Elements:" but the former appears to be the preferable method, as the eye at once detects the character of the argument (if such an expression may be allowed), which is founded on the absurdity of a line being at the same time hypothetically straight and visibly curved. It is, however, a matter of no moment, except as regards facility of apprehension; and it is only referred to, to remark that, as far as my own experience goes, I am led to prefer the curve.

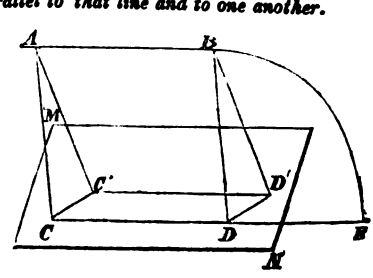
PROP. II.

If a straight line be parallel to a plane, all planes drawn through the line to cut that plane will have their sections with it parallel to that line and to one another.

Let the line AB be parallel to the plane MN, and planes AD, AD′ be drawn through AB to intersect MN in CD, C′D′: then CD, CD′ will be parallel to AB and to one another.

(1). Since AB, CD are in one plane AD, they are either parallel to one another, or they will meet in some point E.

If parallel the proposition is admitted. But if not, then since CD lies wholly in the plane MN, and AB meets CD in E,



the line AB meets the plane MN: whilst by hypothesis the line and plane are parallel, and can therefore never meet. Wherefore the section CD is parallel to AB.

Digitized by Google

(2). The planes AD, AD′ intersecting in the line AB, cannot meet in any other point. Whence the lines CD, C′D′ in them can never meet (*ax.* 10). But these lines CD, C′D′ are in one plane MN; and never meeting, they are parallel.

PROP. III.

If a line without a plane be parallel to a line in that plane, the first line will be parallel to the plane.

Let the line AB without the plane MN be parallel to the line CD in it: then AB will be parallel to the plane MN.

For, since AB, CD are parallel they are in one plane AD, and AB, CD can never meet; and since AD, MN meet in CD, they cannot meet in any point without CD (*ax.* 10). Whence AB, it lying wholly in the plane ACD, can never meet the plane MN: that is, the line AB is parallel to the plane MN.

COROLLARY.

If through CD, one of two parallel lines AB, CD, any plane MN be drawn, this plane will either wholly include the line AB or be parallel to it.

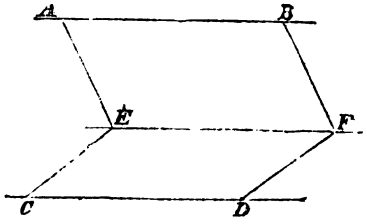
PROP. IV.

If through two parallel lines any planes be drawn, they will either coalesce, be parallel, or have their line of section parallel to those two lines.

(1). The planes may be each drawn through the other line, since parallel lines lie wholly in one plane; and hence would coalesce with the plane which contains the parallels, and consequently with each other.

(2). The planes may never meet, and hence would be parallel.

(3). Let AB, CD, be parallel lines, through which are drawn any two planes AF, CF which neither coalesce nor are parallel; then their section EF of these planes will be parallel to the lines AB, CD.



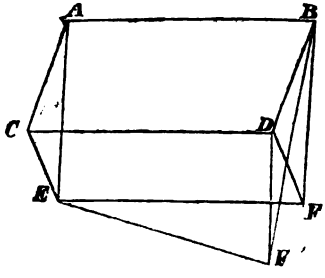
For since AB is parallel to the line CD lying in the plane ED, it is parallel to the plane ED itself (*prop.* 3.); and hence it can never meet the line EF in that plane. But EF is also in the plane AF, since it is the intersection of that plane with the plane ED; and hence AB, EF being in the same plane and never meeting, EF is parallel to AB.

In the same way it is shown that EF is parallel to CD.

PROP. V.

If lines be drawn, one in each of two planes which intersect and both parallel to that intersection, these two lines will be in one plane and parallel to each other.

Let the planes AD, DE intersect in CD, and let AB and EF in those planes respectively be drawn parallel to CD: then AB, EF will be in one plane and parallel to one another.



(1). If AB, EF be not in one plane, draw a plane through AB and E to cut the plane CF in EF′. Then since through the parallels AB, CD planes are drawn which intersect in EF′, this line (EF′) is parallel to CD (*prop.* 4.) But (*hypoth.*) EF is parallel to CD; and hence through the same point E two parallels EF, EF′ can be drawn to the same line CD, which is impossible. Where-

Digitized by Google

fore the plane through AB and E includes the entire line EF; that is, the two lines AB, EF are in one plane.

(2). Again, since CD is parallel to the line AB in the plane ABFE, it is parallel to the plane itself (*prop.* 3.); and since through the line CD which is parallel to the plane ABFE planes are drawn which cut it in AB, EF, these lines are parallel to one another.

Prop. VI.

If two straight be each of them parallel to a third line, though they be not in the same plane with them, they will be parallel to one another.

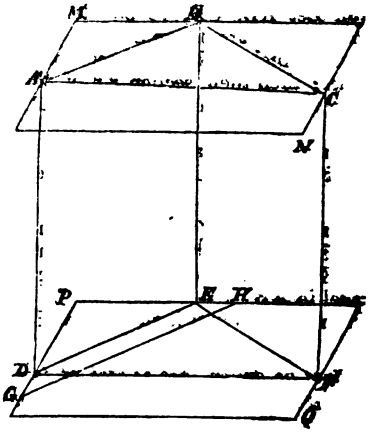
Let AB and EF be parallel to CD, though not all three in the same plane, then AB will be parallel to EF.

For since AB, CD are parallel they are in one plane; and similarly EF, CD are in one plane. These planes meeting in CD, and the lines AB, EF being parallel to their intersection, these lines are parallel to one another (*prop.* 5).

Prop. VII.

If two straight lines which meet be parallel to two others which meet, but not in the same plane with them: the plane which contains the first two will be parallel to the plane which contains the others; and the angle contained by the first two will be equal to the angle contained by the others.

Let AB, BC be parallel respectively to DE, DF: then the plane MN drawn through AB, AC will be parallel to the plane PQ drawn through DE, DF; and the angle BAC will be equal to the angle EDF.



(1.) For if the plane MN be not parallel to PQ, it will cut PQ in a line, which suppose to be GH.

Then since AB is parallel to DE a line in the plane PQ it is itself parallel to PQ (*prop.* 3); and since the plane MN is drawn through a line AB, which is parallel to PQ and cuts PQ in GH, the line GH is parallel to AB (*prop.* 2).

Again, since through DF which is parallel to AC the plane PQ is drawn, the line AC is parallel to PQ; and since the plane MN passes through AC and cuts PQ in GH, the line GH is parallel to AC.

Wherefore AB, AC are both parallel to the same line GH, which is impossible. The planes MN, PQ do not therefore meet in GH; and in the same way they cannot meet in any other line. Whence they are parallel.

(2.) Take AB equal to DE and AC to DF, and join BC, EF, AD, BE, and CF. Then since AB is equal and parallel to DE, they are in the same plane, and AD is equal and parallel to BE (*Euc.* i. 33). For a similar reason AD is equal and parallel to CF. Also, since BE, CF are parallel to AD, they are parallel to one another (*prop.* 6); and they have been proved equal. Whence BC is equal to EF.

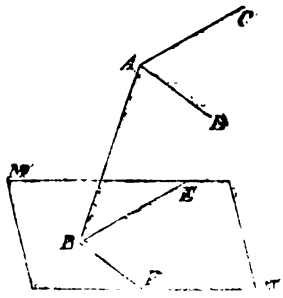
Moreover, since the two sides BA, AC are equal to the two ED, DF, and the base BC to the base EF, the angle BAC is equal to the angle EDF (*Euc.* i. 8).

Digitized by Google

PROP. VIII.

Through the same point without a plane, innumerable lines can be drawn parallel to the plane: but through that point only one plane parallel to the given one: and all the lines parallel to the plane will lie in the plane parallel to it.

Let MN be a plane and A a point without it;—then through A innumerable lines AC, AD, *etc.*, may be drawn, all of which may be parallel to MN: only one plane can be drawn through A parallel to MN: and that plane will contain all the forenamed lines, AC, AD, *etc.*

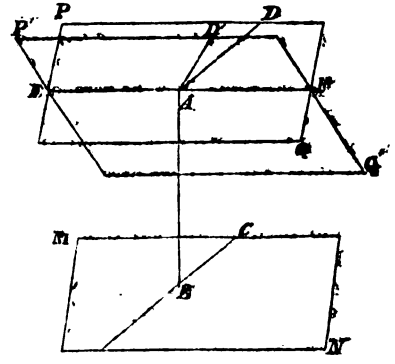


(1.) Draw any line AB to meet the plane MN in B; and through AB describe any number of planes ABE, ABF, *etc.*, cutting MN in BE, BF, *etc.* In these planes draw AC parallel to BE, AD parallel to BF, *etc.*

Then since AC is parallel to a line BE in the plane MN, it will be parallel to the plane MN. In the same manner AD is parallel to the plane MN; and the same reasoning applies to all other lines drawn through A parallel to lines drawn in the plane MN through B. The first part of the proposition is, therefore, true.

(2.) There can be but one plane drawn through A parallel to MN.

For if it be possible, let there be two planes PQ, P′Q′ drawn through A parallel to MN, and intersecting in EF. This line will pass through A, since both the planes PQ, P′Q′ do so. Draw through A, any plane not coinciding with EF to cut MN in BC, PQ in AD, and P′Q′ in AD′. Then since the parallel planes MN, PQ are parallel and cut by a third plane in BC, AD respectively, these lines are parallel (*prop.* 1); and similarly BC, AD′ are parallel. Whence through the same point A two lines AD, AD′ can be drawn parallel to BC; which is impossible. Wherefore, only one plane can be drawn through A parallel to MN.



(3.) All lines through A parallel to MN lie in the plane PQ parallel to MN.

For, if possible, let any line as AD′ which is parallel to MN not lie in the plane MN. Through this draw any plane to cut MN, PQ in AD, BC; and join AB, B being any point in BC.

Then AD, BC are parallel (*prop.* 1), and AD′ is in the same plane with them. Whence AD′ cannot be parallel to BC, and must therefore meet it. But BC is in the plane MN, and hence AD′ will also meet that plane. No line AD′, therefore, out of the plane PQ can be parallel to the plane MN; and it hence follows, that all the lines which are parallel to MN and pass through the point A lie in the plane PQ which is drawn parallel to MN.

COROLLARY 1.

Any line drawn in one of two parallel planes will be parallel to the other plane.

COROLLARY 2.

If a straight line be parallel to a plane, a plane can be always drawn through it parallel to the plane; and there can be only one such plane drawn.

Digitized by Google

Prop. IX.

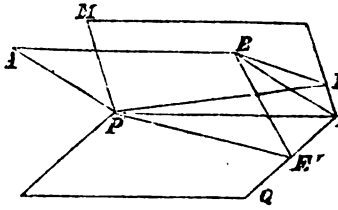
If a line be parallel to the intersection of two planes it will be parallel to each of the planes; and if a line be parallel to two planes it will be parallel to their intersection.

(1.) Let the two planes MN, PQ intersect in PN, and AB be a line parallel to PN: then AB will be parallel to both the planes MN, PQ.

For, since AB, PN are parallel, and the plane MN passes through one of them PN, the line AB is parallel to the plane MN (*prop.* 2). In like manner it can be shown to be parallel to the plane PQ.

(2.) Let the line AB be parallel to each of the planes MN, PQ; it will be parallel to their intersection PN.

For, through AB and any point P in the intersection PN, let a plane be drawn; and if it do not wholly coincide



with PN, let it cut the planes MN, PQ in PE, PF.

Then, since through AB, which is parallel to the plane MN, a plane ABEP has been drawn, the section PE is parallel to AB (*prop.* 2). For a similar reason PF is parallel to AB. Whence through the point P two lines PE, PF can be drawn parallel to the same line AB; which is impossible.

The line PN is, therefore, in the same plane with AB; and since AB is parallel to the plane with which PN coincides, it can never meet PN. Whence AB is parallel to PN.

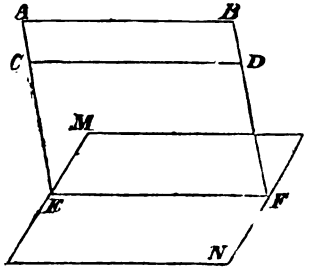
Prop. X.

If a plane be parallel to one of two parallel lines, or to one of two parallel planes, it will be parallel to the other.

(1.) Let the plane MN be parallel to one, AB, of the parallel lines AB, CD: then it will be parallel to the other CD.

For, since AB, CD are parallel they are in one plane: and this plane is either parallel to MN, or will cut it in some line EF.

If ABCD be parallel to MN, the plane MN is parallel to every line CD in ABCD. (*prop.* 8, *cor.* 1.). Whence in this case the proposition is true.

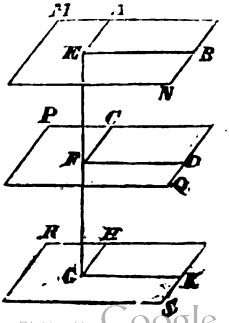


But let the plane ABCD cut MN in the line EF. Then, since MN is parallel to AB, the line EF is also parallel to AB (*prop.* 2). Also (*hypoth.*) CD is parallel to AB; and hence CD is parallel to EF in the plane MN. Wherefore the plane MN is parallel to CD (*prop.* 3). The theorem is, therefore, true.

(2). Let the planes MN and PQ be each of them parallel to RS: they will be parallel to one another.

For, in the extreme planes MN, RS take points E, G, and join EG. This will necessarily cut the intermediate plane PQ in some point F.

Through EG draw any two planes, cutting MN in EA and EB, PQ in FC and FD, and RS in GH and GK.



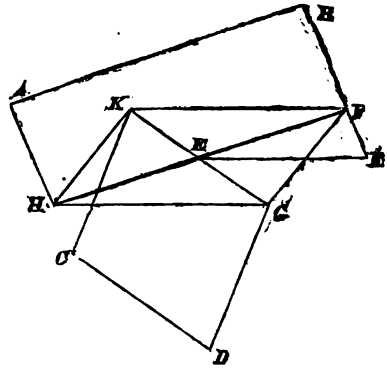
Digitized by Google

Then since MN is parallel to RS, the sections EA, GH are parallel (*prop.* 1.); and for a similar reason the sections FC, GH are parallel. Wherefore EA, FC are also parallel to one another.

In the same way it may be shown that EB, FD are each parallel to GK, and therefore to one another. Whence also, the planes MN, PQ in which these parallel lines are respectively situated, are also parallel to one another. (*Prop.* 8).

PROP. XI.

Through a given point only one plane can be drawn parallel to two given lines which are not themselves parallel: but when the given lines are parallel, innumerable planes may be drawn parallel to both of them.



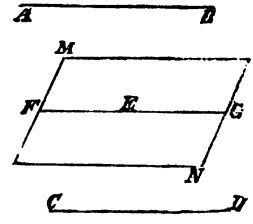
(1). Let AB, CD not be parallel (though in the same plane or not) and let E be any point whatever: then through E one plane, and only one, can be drawn which shall be parallel both to AB and CD.

Through E one line EF, and one only, can be drawn parallel to AB; and one, and one only, parallel to CD.

The line AB being parallel to the line EF, is parallel to the plane GEF in which EF is situated. Similarly CD is parallel to the plane GEF. Wherefore the plane GEF is parallel to both the lines AB, CD; and hence one plane can be drawn through E parallel both to AB and CD.

Nor can there be drawn any other plane parallel to AB and CD. For, if there can, let it cut the plane through AB and E in the line EF'.

Then since AB is parallel to the second plane, the section EF' is parallel to AB (*prop.* 2). But EF is also parallel to AB. Whence through E two lines EF, EF' can be drawn parallel to AB: which is impossible (*ax.* 11). Wherefore no other plane besides GEF can be drawn parallel to AB and CD.



(2). Let the lines AB, CD be parallel: then innumerable planes may be drawn through E parallel to both of them, whether E be in the same plane with them or not.

For, through E draw a line FG parallel to AB; it will also be parallel to CD. Through FG draw any plane MN: this will be parallel to AB and CD.

For, since AB is parallel to FG a line in the plane MN it is parallel to the plane MN itself (*prop.* 3). In the same manner CD is parallel to MN. That is, the plane MN is parallel to AB and CD.

(*To be continued.*)

ENGINEERING AT THE ROYAL AGRICULTURAL SHOW, NORTHAMPTON.

Sir,—The application of steam power to purposes of agriculture is almost a new feature in the annals of modern progress, and, as such, is worthy of attention by all who have the growing interests of the community at heart.

The Royal Agricultural Society of England held its meeting this year at Northampton; and one of its greatest features was the number of portable steam-engines, as applicable to thrashing and other purposes.

Digitized by Google

The whole of the steam-engines (seven in number), with their accompanying thrashing-machines, were placed in the trial yard (adjoining the large implement yard), where excellent arrangements had been made for their reception. A large quantity of corn, in the straw, was provided, and coals for getting up the steam and working the various engines during the intended trial.

The result of this so-called *trial* has been anything but fair to those persons who exhibited steam engines, and far from satisfactory to the public.

I enclose you a copy of three resolutions adopted by the unsuccessful exhibitors, which, you will observe, do not contain merely the objections of one or two individuals, but are the unanimous protest, on common ground, of all parties concerned, and will be sufficient to show, without any comment from me, the uniform dissatisfaction created by the award of the judges. I beg, however, to offer a few observations relative to the arrangements for the trial—not by any means with a view to stir up ill feeling, but to prevent the recurrence of superficial investigation, and consequent error, on future occasions.

The Society offer in their list of prizes, "For the *best* portable or fixed steam-engine, applicable to threshing, and other agricultural purposes, 50*l*."

The parties appointed to investigate the merits of these engines, were *two farmers!* Now, without disparaging the general scientific knowledge and abilities of these gentlemen in agricultural matters, it does appear out of place that they should have been chosen to examine the details and test the capabilities of steam-engines.

The impropriety of such an arrangement is abundantly evident from the following facts:—Each of the engines exhibited was different in construction and mode of working from the others; and ten minutes was all the time that these off-hand gentlemen allowed themselves for their elaborate experiments with each engine. No account was taken as to the time in getting up the steam, consumption of fuel, the working pressure as consistent with safety, comparative security from fire, and other important details of mechanical arrangement.

As might be expected, the prices of these engines varied, according to the size, construction, and general advantages of each; but all those important properties, so necessary to the effective and profitable employment of steam power, and which a practical engineer would take first into consideration, were entirely unappreciated by the agricultural gentlemen who undertook the disposal of the Society's prize for the "BEST *steam-engine*," and who awarded it to the one *lowest in price*, without any other apparent consideration.

I hope the dissatisfaction so widely manifested this year, will tend to improve the practice of the Council in their future trials of machinery; feeling fully convinced that no method could be more certain to lessen the extent and usefulness of the Society than such futile and inefficient regulations.

Yours, respectfully,

J. STANION.

Northampton, July 27, 1847.

The Resolutions.

At a Meeting of the *Exhibitors of Steam Engines*, at the Royal Agricultural Society of England's Meeting at Northampton, held this 21st day of July, 1847,

PRESENT:

Mr. OGG, Jun. of Northampton, in the chair.
Messrs. BARRET, ASHTON, & Co., of Hull;
Mr. WILLIAM BLOXOM, of Gillmerton;
Messrs. Ryland and Deem, of Birmingham;
Mr. JOHNSON, of Leicester, for Self and Mr. J. W. SHARMON, of Wellingborough, and Mr. W. P. STANLEY, of Peterborough;

It was resolved unanimously,

1st. That, in the opinion of this meeting, the Judges are chargeable with great injustice towards the unsuccessful Exhibitors of Steam Engines, in awarding the Prize of 50*l*., offered by the Society for the best Steam Engine, to the one, of all those exhibited, which this meeting considers as the *least* entitled to the Prize; and that, bearing in mind the determination *so emphatically* expressed by the Judges, to pay *particular attention* to the consumption of Fuel and the Pressure of Steam, Strength and Capacity of Boiler, and to all points affecting the safety of the public, this meeting is at a loss to account for so *flagrant a violation* of these principles, as the award of the Prize to an engine which (it was notorious) consumed nearly *twice the quantity of coal* used by others exhibited, was working at a pressure exceeding 30 lbs. per inch, and at a speed of 240 to 250 revolutions per minute; the

Digitized by Google

result of which (as could only be anticipated) was the partial destruction of the Thrashing Machine, at the imminent danger of all parties employed about it.

2nd. That this meeting is further of opinion, that a *palpable deception* has been practised upon the Judges in the entry of Mr. Cambridge's Steam Engine as one of *Four-horse Power*: whereas the capacity of the cylinder, viz. 6 inches diameter, with only a 12-inch stroke, are but equivalent (at the highest pressure that may be considered as safe in the hands of inexperienced persons) to about *Three-horse Power*. That an erroneous impression is thereby created as to the *relative Price of* the Engine, and that under these circumstances, the said Engine is *disqualified for competing*, and therefore *not entitled to the Prize*.

3rd. That this meeting is much disappointed that the disposal of the Prize for Steam Engines was not deputed to Mr. PARKES, or some other acknowledged practical and competent Engineer; and express their determination never to exhibit a Steam Engine at the future meetings of the Society, until such arrangements shall be made as will ensure an *ample trial* and a *proper adjudication*.

ON THE DEMONSTRATION OF THE PARALLELOGRAM OF FORCES IN POISSON'S MECHANICS.

SIR,—In the excellent and instructive notes on this demonstration, by J. J., of Exeter, contained in pp. 38—40 of the current volume of your Magazine, we have $\frac{d^2\phi s}{\phi s dx} = \text{constant} = c$; and after deducing the value of ϕs, the *substitution of* $c = -a^2$, gives $\phi s = 2\cos. ax$. Now, in perusing these notes, it occurred to me whether an assumption could not be made which would give ϕx *without substitution*, and on referring to Dr. Lloyd's excellent "Treatise of Mechanical Philosophy," I find it already done by assuming $\frac{d^2\phi x}{\phi x dx} = -m^2$. If the above possess sufficient interest to merit a place in your pages, their insertion will much oblige

Yours respectfully,
THOMAS WILKINSON.

Burley, Lancashire, July 24, 1847.

P.S. Allow me to add, that Professor Young gives a demonstration little differing from that by "J. J.," in his "Elements of Mechanics;" a work which, it appears, is not known to the learned writer of the "Remarks on the Use of Mathematical Knowledge to Engineers," but which, I think, would well bear comparison with some of the treatises he has enumerated.

T. W.

RAILWAYS—SUGGESTIONS FOR THEIR SAFER CONSTRUCTION.

SIR,—Allow me to tender my grateful thanks for your kindly inserting my humble opinions relating to the construction of railways, &c. I herewith send you the copy of the *Sun* newspaper; and although it is two years since it first saw the light, I still am of the same opinion as regards the utility of the plan therein developed. Should you deem it worthy a place in your intelligent Magazine, I should feel myself highly honoured.

I am, Mr. Editor,
Yours most thankfully,
JOHN SUTTON,
42, Stamford-street, formerly of
14, Crown-row, Walworth-road.
July 12th, 1847.

"To the Editor of the Sun.

"Sir,—Would you allow me, through your journal, to call the attention of the chairmen of the various committees on railways to strongly enforce, in their Reports to the House, of such lines as they may think worthy of adoption, the positive necessity of compelling all future lines to have safety flange-rails, on the old-fashioned tram-rail principle; thereby avoiding all possibility of accident by the trains getting off the line, and moreover preventing most serious consequences, should two trains meet or run into each other. The present rate of velocity, though it may be 50 miles an hour, is but slow work to what it will be, some five years hence, and as such, something ought to be done to compel the companies to make the lines safe, without the least possibility of accident—thereby ensuring confidence in the public mind, and a corresponding increasing traffic for the benefit of the shareholders. It is no joke to travel in fear, and be only at ease when you arrive safe at your journey's end. A day will come when some most disastrous accident will happen to the highly born, and then, no doubt, amendment will follow. Few, very few, are aware upon what a narrow edge or brink they are travelling, and that a mere flanch, not more than an inch and a quarter deep, from the sole of the wheel, is all the security they have of the train keeping within the rails.

Digitized by Google

Moreover, the wheel, in its rapid revolution, is exerting itself with all its might at every oblique movement of the carriage, to get this narrow flanch over the rail, and were it not for the downward pressure, it would very soon accomplish.

"Engineers prefer edgerails to tramrails, because they look nicer to the eye, though they know full well the tramrails may be made quite as strong—I say stronger than the edgerails. Now, Mr. Editor, as I cannot give you a diagram, I will explain myself thus briefly:—Take a bit of paper, the length no matter, but the width must be, say 28 inches. Now, fold the paper longitudinally, 12 inches from the outer edge; turn the paper over and fold this side also 12 inches from the outer edge. Now, the two folds will be back to back, and if you open these folds, you will have a settee-like form of rail, consisting of a back or flange 12 inches deep, a seat or level surface 4 inches wide, and a bottom or lower flange 12 inches deep. Now, if you turn the paper over, you still will have the same form presented to you; thus proving that the rail will possess a most everlasting wear, as, when the upper side is injured or worn, it may be turned over, and what was underneath will in like turn become the future rail. Upon the 4-inch level surface or ledge the soles of the wheel will rest or travel, having a high flange facing their outer side, and a corresponding one downward inside. These rails may be either fixed in chairs, or else fastened to the sleepers by screw bolts. There must be on the outer side of the upper flange brackets or stays, fastened at their upper part to the flange, and at their lower part to the cross sleeper; and thus we shall have, as it were, a trunk or channel railway, with an utter impossibility of the train ever getting or running off the line, as it will be kept from swerving to the right or left by the upper flange. The outer edge of the sole of the wheel need not touch the upper flange, thereby avoiding friction, but the upper flange will present to the wheel, should it be inclined to swerve by its rapid progress, a butt, or throw-off, which the wheel would merely play, as it were, against, but over which it could not go, for the want of a direct bite. These high flanges may be either erect or outwardly inclined a little. This channel railway, as I shall call it, is not intended to supersede the flange of the wheels, but they ought to be made a little deeper; their present depth is quite inadequate to their purpose, viz. keeping the train on the line. Now, should this channel railway be not approved of, then let the present flimsy rails remain; but, for the safety of all, let there be flanges bolted on to the inner side of each wheel, full 12 to 14 inches in depth. Never mind the look, so we, the travellers, are safe. These flanges may be slightly tapering towards their outer edge, so as to avoid unnecessary friction.

"With these remarks we will have done, except to draw the following conclusions:—First. That with these alterations there will be an utter impossibility of the trains leaving the line, either by jumping, jolting, hopping, or bounding, or oscillating: or should two trains meet, their headlong butt will be in a straight line, not as it is at present, sideways. But one thing will happen with these alterations, through the present imperfect mode of placing the buffer-springs: the two engines, the moment they meet, will rear up, ram-like, both by their own impetus, and that of the hinder carriages pressing hard upon them; but if the buffer-springs were placed higher up, say two-thirds from the ground, they not only would not trip or rear up, but could not run into or over each other, but each carriage would receive no more than the amount of shock due to that carriage, according to its distance from the point of collision, as it will be no more than a very severe thrust, and not an overturning shock. This part deserves very great attention, as the buffers, which are intended to ease, if not avoid, a casualty, are the very things, through their being misplaced, that cause the overthrow of the carriages. Again, I do not see why there should not be eight buffer springs to each carriage, four in front and four behind, placed thus,—two in front, one on each side, one-third from the ground, the other two front ones, one on each side, one-third from the top; but these top ones ought to be a little longer than the bottom, so that they may receive the shock first. Now, the hinder ones are to be placed in the same manner; and if these buffers are furnished with a plug and key sort of adjustment, they may, when a severe shock takes place, become firmly keyed or locked into each other; and thus the whole line of carriages, at least those who are in the vicinity of the shock, will become as one body immovable, no running over each other or overturning; as they are as one carriage firmly united with the buffers, but which may be instantly disconnected by suitable gear.

"Note.—The accident that happened this week on the Great Western Line to the rapid train was caused by the jumping, or hopping to and fro swerve of the carriages, through there being no stay flanch to the rails, but merely the foolish inch flanch of the wheels. Many will say the flange rail

Digitized by Google

will be too expensive for the companies to adopt. I say, No; a very great saving will arise from it, not only by no accident ever happening of any moment, and, therefore, no expense in repairs, but a very great increase of passengers will take place, through the great confidence the people will have in the channel railway.

"I am, Mr. Editor,

"Yours respectfully,

"JOHN SUTTON.

"14, Crown-court, Walworth, June 20th, 1845."

P.S. (July 12th, 1847.) The thought will naturally arise, How are the buffers to lock into each other when the train is at a curve? I would humbly suggest, that to meet this objection, the key, or tongue, or perhaps it would be more explicit to call it the male buffer (and the one it enters or locks into, the female buffer)—I say that this male buffer should have a side or horizontal to and fro play, (not up and down,) in a slight degree, so as to adapt itself to the curve of the rail. A very little side motion will be necessary, as two carriages joined or locked together will have to depart but a very little from the straight line in the formation of any curve that ought to exist. And as regards any up and down motion in these locking buffers, it must wholly depend upon the relative situation and tenseness or laxity of the springs.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 94.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

John Harmer, of Sheffield, clerk: of a machine for raising a shag on all sorts of woollen cloths, and cropping or shearing them, which together come under the description of dressing woollen cloths, and also for cropping or shearing fustians. Cl. R., 27 Geo. 3, p. 17, No. 14. March 20, 27 Geo. 3; April 10, 1787, 27 Geo. 3.

Thomas Sandys, of Bristol, lace and fringe manufacturer: of a machine for throwing and organizing of silk, and for throwing and twisting of worsted, mohair, thread, cotton, hemp, flax, and gold and silver cords. Cl. R., 27 Geo. 3, p. 18, No. 9. May 19, 27 Geo. 3; June 2, 1787.

John Wright, of Thurnscoe (York), farmer: for a drill plough of an entire new construction, calculated for the purpose of sowing all kinds of pulse, grain, and seeds in such a manner as will save expense in the cultivation of land, and at the same time in the manuring thereof. Cl. R., 27 Geo. 3, p. 18, No. 1. July 3, 27 Geo. 3; certified July 28, 1787.

William Purnell, of Dursley (Gloucester), iron master: of an invention of an entirnew mode of preparing, shingling and welding iron with pit-coal from the ore, as also from sow or pig metal, and every other sort of cast iron, entirely by the application of a machine constructed and applied as to render it of a superior quality and in much greater quantities, and with a very considerable less expense of fuel and waste of metal than hath hitherto been done by any method yet used. Cl. R., 27 Geo. 3, p. 19, No. 1. June 5, 27 Geo. 3; June 27, 1787.

William Cooper, of Sheffield (York), tallow chandler: of a machine for cleaning, spreading, twisting, and cutting cotton and making wicks for candles. Cl. R., 27 Geo. 3, p. 21, No. 9. August 11, last; September 5, 1787.

Nathaniel Watts, of Stroud (Gloucester), clothier: of a new method of dying in boiling liquors woollen cloth, or such articles as are composed chiefly of woollen in various devices representing foliages, scrolls, lines, and any other adapted forms, and this in pieces of sufficient size for the foreparts of a waistcoat or vest (viz.,), from eight to sixteen nails long, and from five to ten broad, which is effected by means of certain frames and moulds made of hard metals. Cl. R., 27 Geo. 3, p. 24, No. 3. Nov. 22, 28 Geo. 3; Dec. 17, 1787.

Joseph Rabone, of Birmingham, button maker: of a new method of making and manufacturing coat and waistcoat buttons of black or of any other colour or mixture of colours both plain and figured out of or from bone and ivory. Cl. R., 27 Geo. 3, p. 25, No. 5. January 14, 27 Geo. 3; Feb. 6, 1787, 27 Geo. 3.

Richard Fishwick, of Elswick (Northumberland), white lead maker: of a new method of making white lead. Cl. R., 27 Geo. 3, p. 25, No. 4. Jan. 15 last past; Feb. 14, 1787, 27 Geo. 3.

Robert Hickman, of Edgbaston (Warwick), button maker: of a method of making and manufacturing gilt and plated coat and waistcoat buttons by uniting or amalgamating with or by means of tin and lead, mixed gilt and plated metal button shells, both coloured, plain, and figured, with bottoms of copper, brass, iron, mixed and compound metals. Cl. R., 27 Geo. 3, p. 25, No. 3. Feb. 1, instant, 27 Geo. 3; February 20, 27 Geo. 3, 1787.

Digitized by Google

John Miles, of Birmingham, gent. : of an invention of making lamps in different forms and of any kind of metal or metallic substances, to be used without inconvenience on horses, carriages, breasts of men, or any body under motion, so as to give perfect light though ever so much agitated, or to be used in halls, on staircases, tables, desks, or for other purposes where motion is not required. Cl. R., 27 Geo. 3, p. 26, No. 7. Feburary 12, 27 Geo. 3; March 7, 27 Geo. 3, 1787.

James Storey of Tynemouth, esq. : of a certain machine for drawing and raising of water out of mines, and for other purposes. Cl. R., 27 Geo. 3, p. 28, No. 14. May 10, 27 Geo. 3; May 26, 27 Geo. 3, 1787.

James Alston, of Birmingham, buckle and button maker : of a new manner of making buttons of iron or steel covered with tin and other metal, or tin alone. Cl. R., 27 Geo. 3, p. 31, No. 1. Oct. 30, 28 Geo. 3; Nov. 26, 1787.

(*To be continued.*)

LIST OF ENGLISH PATENTS GRANTED ON JULY, 24 TO JULY 29, 1847.

John Platt, of Oldham, Lancashire, and Thomas Palmer, of the same place, for certain improvements in machinery or apparatus for making cards, also for preparing and spinning cotton and other fibrous materials, and for preparing and dressing yarn, and weaving the same. July 24; six months.

Charles De Bargue, of Arthur-street West, City, for improvements in buffing and traction apparatus, and in springs for railway and other carriages. July 26; six months.

Alfred Ceal, of Aldgate, manufacturer, and Henry Bear, of New-road, manufacturer, for improvements in the manufacture of tobacco. July 28; six months.

Edward Ryan, of Park-place, Bayswater, Middlesex, for improvements in consuming the smoke and economizing the fuel of steam-engines, breweries, and manufactories generally. July 28; six months.

James Morison, of Paisley, shawl manufacturer, for improvements in applying power in propelling or moving carriages, and in giving motion to machinery. July 29; six months.

Joseph Paul, of Thorp Abbott's-hall, Norfolk, farmer, for improvements in cutting or forming drains in land, and for raising subsoils to the surface of land. July 29; six months.

Francis Starr, of Warwick, for a new jet for the delivery of water and other fluids, which he styles the "Protean Jet." July 29; six months.

William Baines, of Norwich, inspector of railways, for improvements in the manufacture of parts of railways, and in the bearings of machinery, and in apparatus used in constructing railways. July 29; six months.

Alfred Vincent Newton, of 66, Chancery-lane, mechanical draughtsman, for an improved kiln, or oven, for firing porcelain and other similar ware. July 29, six months.

William Phillips Parker, of 48, Lime-street, City, gent., for an improved mode of manufacturing cigars. July 29; six months.

George Witherell, of New York, America, for improvements in manufacturing or working iron for various useful purposes. July 29; six months.

Stopford Thomas Jones, of Stamford-street, Surrey, for improvements in steam-engines, and in machinery for propelling vessels. July 29; six months.

John Hastie, of Greenock, Scotland, engineer, for improvements in the application of steam power to turn certain kinds of mills or machines with a continuous rotary motion. July 29; six months.

MONTHLY LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 23RD OF JUNE TO THE 31ST OF JULY, 1847.

William Darling, of Glasgow, ironmonger, for improvements in moulding, and in the manufacture of certain articles of cast iron. June 23.

Thomas Craddock, of Birmingham, Warwick, engineer, for improvements in steam-engines and boilers, and in machinery connected therewith. June 23.

Clemence Augustus Kurtz, of Manchester, Lancaster, manufacturing chemist, for improvements in the mode of preparing and using indigo in the dyeing and printing of woollen, cotton, and other fabrics. June 29.

Clemence Augustus Kurtz, of Manchester, Lancaster, manufacturing chemist, for a new manufacture of certain colouring matter to be used in the dyeing, or in the printing of woollen, cotton, silk, and other fabrics. June 29.

William Knewelden, of Great Guildford-street, Southwark, engineer, for improvements in steam engines. June 30.

John Shaw, of Blackburn, Lancaster, manager, for certain improvements in machinery or apparatus for carding, drawing, slubbing, and roving cotton, wool, and other fibrous substances. July 2.

Paul Gilbert Preiler, of Rue des Rivoli, Paris, in the kingdom of France, gent., for improvements in the manufacture of dry sulphuric acid, and in the manufacture of smoking or nordhausen sulphuric acid. (Being a communication from abroad.) July 9.

George Winslow, now of Boston, in the state of Massachusets and United States of America, merchant, but lately of Burton Crescent, Middlesex, for improvements in machinery for manufacturing files and rasps. (Being a communication from abroad.) July 12.

John Law, of York-place, Portman-square, Middlesex, gent., for improvements in yarns and in the machinery by which the same are manufactured. (Being a communication from abroad.) July 13.

William Edward Newton, of 66, Chancery-lane, Middlesex, civil engineer, for improvements in the manufacture of screws. (Being a communication from abroad.) July 19.

Henry John Nicoll, of No. 114, Regent-street, Middlesex, tailor, for improvements in garments, in pockets, bags, and other receptacles. July 19.

Edward Slaughter, of Avonside Iron Works, Bristol, engineer, for improvements in locomotive engines. July 20.

William Broadbent, of Manchester, and of Little Lever, both of Lancaster, paper manufacturer and dealer, for improvements in the manufacture of paper. July 21.

James Johnstone, of Willow-park, Greenock, esq., for certain improvements in the manufacture of sugar. July 21.

Egbert Hedge, formerly residing at 7, Howard-street, Saint Clement's Danes, Middlesex, now residing at the Commercial Hotel, Blackfriar's-road, Surrey, gent., for certain improvements in rails for railways, and in the manner of securing them. July 22.

William Breynton, of the Inner Temple, London, esq., for certain improvements in rotary steam engines, and in the means of working the same. July 21.

Digitized by Google

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
July 23	1145	Walter Neilson and William Tate	Hyde-park Foundry, Glasgow	Railway wheel spoke binding machine.
24	1146	James Buchanan	Glasgow	Ventilating case for wet umbrellas.
„	1147	Philemon Augustin Morley	Birmingham	Iron hoop for sugar moulds.
„	1148	John Cole	Boston, Lincolnshire, gunmaker	Breech for firearms.
25	1149	Thomas Saddleton Reeler	Cornwall-place, Brecknock-street	Invisible raising screw for music-stools, and other articles of furniture.
27	1150	Griffiths and Hopkins	Birmingham	Roasting, baking, and warming apparatus.
28	1151	Phillip Henry Broadhurst and John Wood, jun.	Sheffield, manufacturers	Shoe and iron.

Advertisements.

TO MINE AND COLLIERY PROPRIETORS, SLATE QUARRY OWNERS, RAILWAY CONTRACTORS, IRONMONGERS, DEALERS IN GUNPOWDER, AND OTHERS.

MESSRS. JOHN HALL AND SON, THE PATENTEES AND SOLE MANUFACTURERS OF

SCHONBEIN'S PATENT GUN-COTTON,

Respectfully state, that they are now prepared to SUPPLY the PATENT GUN-COTTON (compressed for the convenience of carriage), in round and square paper cases, of 4 ozs. each, packed in boxes, containing 50 and 100 cases each, at the price of 3s. per lb., for ready money.

Also, in tubes or cartridges of... 1, 1½, 1¾, and 1¾ inch diameter;
Containing ..... 2, 4, 6, and 8 ounces each, at the
Additional charge of..... 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 3 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

Office, 23, *Lombard-street*, *London*.

Money given away.

THE following Sums of MONEY, viz., £500, £200, £100, £50, two of £25, and ten of £10 will be presented by the Proprietors of the *Jersey Telegraph* to the first 5,000 Subscribers to that paper for One Year from this date, and a like sum to every additional 5,000. The Subscription, 5s., can be forwarded through any bookseller or news-agent, or in Postage Stamps, or by Post-office Order, payable to MR. CHARLES CLIFFORD, *Telegraph* Office, No. 15, King-street, Jersey. Parties forwarding £1 1s. will be entitled to three papers, and may obtain £200.

Advertisers wishing to avail themselves of the very extensive circulation (in England, Ireland, Scotland, Wales, and the Channel Islands) secured by this arrangement, will, to ensure insertion, forward their Advertisements with as little delay as possible. Charge, *only One Penny per Line* (no duty). By the census of 1841, the population of Jersey was about 50,000, which has since enormously increased.

Agencies of all kinds undertaken for Jersey.

The *Jersey Telegraph* can be sent (free) by Post to any part of the United Kingdom and the Colonies.

Jersey, 14th *July*, 1847.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are, that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs T. Burnell and Co., 1, Great Winchester-street, London.

CONTENTS OF THIS NUMBER.

Description of Craddock's Patent Steam Engine Condenser—(*with engravings*) 97

Iron Bridges.—Investigation of the Strength of Cast-Iron Beams or Girders employed in the Construction of Bridges. By Wm. Dredge, Esq., C. E. 101

On Aerostation and Mr. Pitter's Archimedean Balloon 106

The "College of Preceptors" 107

Geometry of the Line and Plane. By T. S. Davies. F.R.S., L. and E., F.S.A., Royal Military Academy, Woolwich 108

Engineering at the Royal Agricultural Show, Northampton 112

On the demonstration of the Parallelogram of Forces in Poisson's Mechanics. By Thomas Wilkinson, Esq. 115

Railways—Suggestions for their Safer Construction. By Mr. John Sutton 115

Calendar of Specifications—(*continued*) 117

Weekly List of New English Patents 118

Monthly List of New Scotch Patents 118

Advertisements 119

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1252.] SATURDAY, AUGUST 7. [Price 3d.
Edited by J. C. Robertson, 166 Fleet-street.

CRADDOCK'S HIGH-PRESSURE, EXPANSION, AND CONDENSING STEAM-ENGINE.

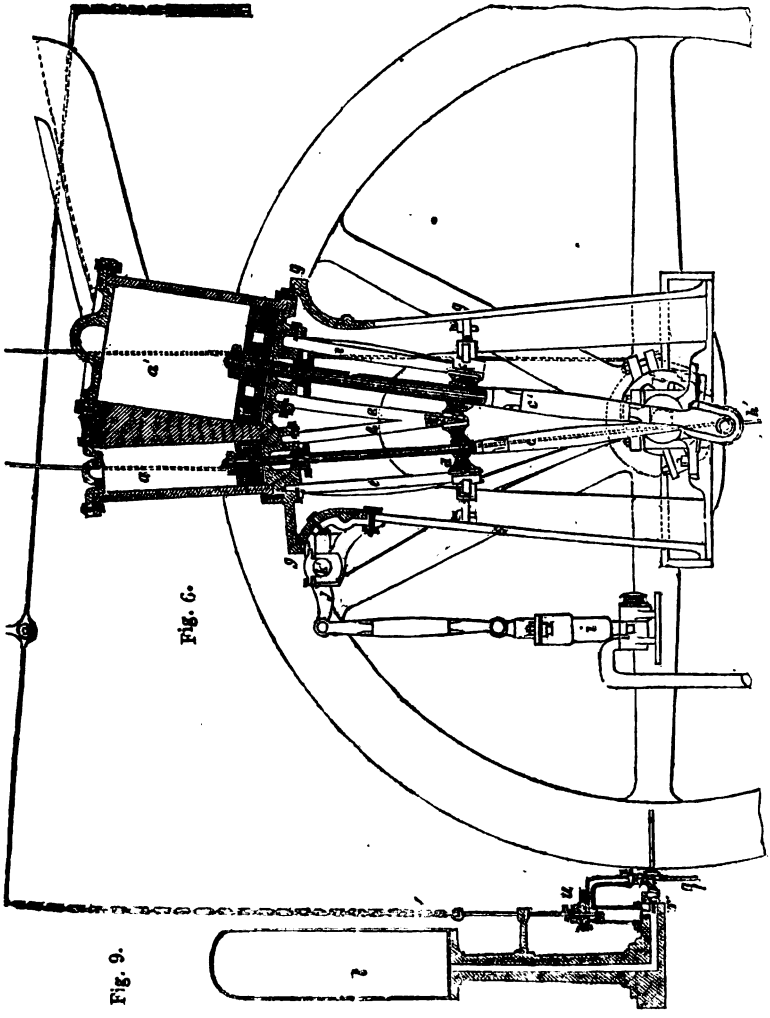


Fig. 6.

Fig. 9.

Digitized by Google

CRADDOCK'S HIGH-PRESSURE, EXPANSION, AND CONDENSING STEAM-ENGINE.

[Patent dated December 3rd, 1846. Specification enrolled June 3rd, 1847.]

We now proceed, in continuation of the article in our last number, to extract from Mr. Craddock's specification an account of his high-pressure, expansion, and condensing engine, which, besides embodying his improved system of condensation (described in our last number), presents the following striking peculiarities:

1st. A new mode of obtaining direct action, by inclining the engines at an angle towards each other, instead of placing them in parallel positions.

2nd. A boiler with vertical water-tubes.

3rd. A self-acting damper, which ensures an uniform emission of steam.

4th. A new arrangement of the steam-chest, whereby the evil of priming is obviated.

5th. An improved air-pump.

6th. Improved slide-valves. And,

7th. A combination in the same engine of more or less of the advantages peculiar to each of the three systems—high-pressure, expansion, and condensation.

In judging, however, of the advantages arising from the triple combination referred to under the 7th head, we must again caution the reader to keep in mind that the inventor insists upon them only where water is scarce, or not conveniently obtainable, as on railways.

Mr. Craddock quotes from (*Chemistry of the Steam Engine*) a Report made by Mr. Cowper, a foreman in the Smethwick establishment of Messrs. Fox, Henderson, and Co., the following account of the results obtained from the *first* engine ever constructed on the plan about to be described. It was an engine with two cylinders, one small and one large (on the well-known plan of Hornblower); the area of the small or high-pressure was 38·5 square ins.—velocity of the piston, 146 feet per minute—average effective pressure, 77·82 lbs. per in.; the area of the large or expanding cylinder, 156 ins.—velocity of piston, 220—pressure, 10·16 lbs. The following is Mr. Cowper's report:

"I have to report the following in reference to 'Craddock's Universal Condensing Engine:'—The condenser is now, after many months' work, quite as perfect and air-tight as it was when first started. There is no appearance of wear or deterioration of any kind having taken place, excepting, of course, the stop brass, which is somewhat worn. The condenser has continued to give a very steady vacuum of 22 or 23 inches of mercury, according to the work put on, and the state of the weather, which does not generally affect the vacuum more than about one inch of mercury. The condenser requires about one and a half horse power of the engine to drive it; but it enables one to obtain a much larger amount of power, in consequence of the vacuum obtained, and the means it thus gives of using more expansion than would otherwise be possible with a high-pressure engine, supposing water to be scarce or expensive. The boiler is, no doubt, very safe, as, even in case of a tube giving way, no serious danger would occur to any person. But the circumstance of there being so small a quantity of water contained in the boiler, necessarily occasions a greater irregularity in the pressure of the steam, supposing the fire to vary somewhat. The self-acting damper is a very ingenious contrivance, and answers its purpose very well; it is applicable to any boiler, whether high or low pressure, and is a great help in keeping the pressure of the steam regular in the boiler.

"The indicator figures I have taken off the engine, show that a vacuum of 9 lbs. per square inch is fully realized in the large cylinder, supposing steam of about 80 lbs. pressure per square inch to be used in the small cylinder of the engine."

Mr. Craddock admits this report to be "perfectly fair and candid," but claims at the same time such allowances for a first performance as no person of common candour will be indisposed to concede.

"It must be borne in mind that the boiler was the first attempt at a thing of the kind; and was constructed, as I have said, not for continued practical use, but merely to test the principles; yet the boiler is still in work, and confirming, beyond a question, the soundness of the principles embodied in it. All that is required to make it as durable, as little liable to derangement, and much more free from danger than the usual Cornish boiler, is a little more experience in its construction, with a better proportioning of it to its purpose; nor would it be more expensive than the Cornish boiler for the production of the same power."

We now proceed to our extracts from the specification:—

Digitized by Google

Figs. 10.

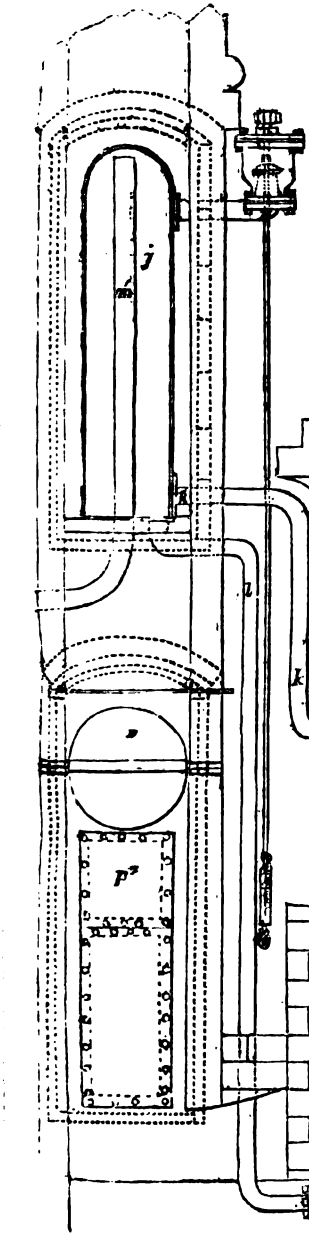


Fig. 11.

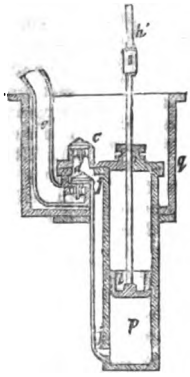


Fig. 12.

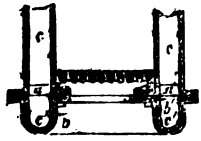


Fig. 13.

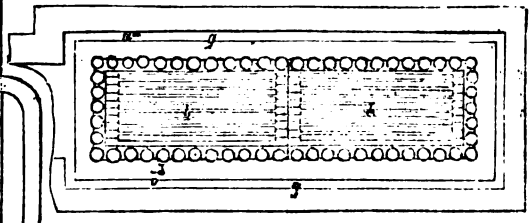
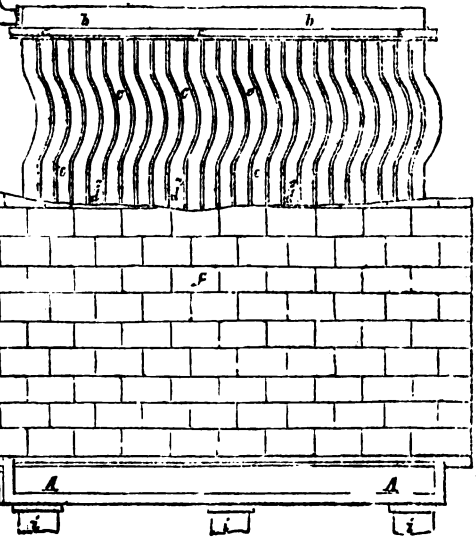


Fig. 8.



Digitized by Google

The Engines.

Figure 6 is a longitudinal elevation of a stationary engine of this description, and fig. 7 a transverse elevation. The two cylinders *a* and a^1, which are, as usual, one small (for high pressure) and the other large (for low pressure), are set at such an angle in respect of one another, as that two lines, drawn through the centres of the cylinders respectively, shall meet in the centre of the main shaft on which the crank is fixed. The piston-rods *b* and b^1 are connected through the medium of cross-heads *d* and d^1, and connecting-rods *c* and c^1, with one crank-pin c^2, the lower end of the rod c^1 being forked (see fig. 7) in order to admit within it the end of the other rod *c*. *e e e e* are guides on which the guide brasses *f f f f* slide. *g g* is the framework of the engine. h^1 is a rod which gives motion from the cross-head *d* to the air-pump *p*. *i* is the boiler pump worked through a lever *j* affixed to the weigh-shaft k^1, from which shaft the steam valves (afterwards separately described) are also worked. l^1 is the eccentric; *m* the rod which gives motion to the weigh-shaft k^1; m^1 is the steam induction pipe, and *n* the safety-valve; n^1 n^1 plummer blocks, *o* the damper, and p^2 the distilling vessel.

By connecting the piston-rods with one crank-pin, in the manner which has been just described, a direct action is obtained from the two cylinders in a more favourable manner than has yet been accomplished in engines of this description, and a considerable saving of space and material is at the same time effected.

The Boiler and Furnace.

Figure 8 is a side-elevation of the boiler and furnace, with part of the brickwork in which it is set removed. A is the brickwork in which the boiler is set. The boiler is composed of a number of vertical water tubes *c c c*, which are uniformly curved, as shown, in order to allow for the effects of expansion and contraction, and arranged in a quadrangular form round the furnace which is fed from the top. These tubes are inserted at top and bottom into wrought iron plates *a a a a*, and secured by ferules *d d* in the same way as in the ordinary locomotive engine; and after they have been thus fixed in their places they are closed in at top by a hollow rectangular chamber, *b b*, and at bottom by another single chamber b^1 b^1, which chambers are bolted or screwed on to the plates *a a*, and have curved channels c^1 c^1 running along their edges, so that there may be a free intercommunication between the whole series of pipes both longitudinally and transversely. The fire-grating *h h* is made in two parts, which turn on hinges at their outer ends, so that they may be let down occasionally to allow of the escape of any clinkers or unconsumed matters which may happen to accumulate on the grating. The strips of cast iron d^2 d^2 are inserted in the spaces between the tubes, as high up as the dotted line *e e* (fig. 8); but above that line they are left open for the flame and heated vapours to circulate amongst them previous to their escaping into the chimney by the flue *g* which is made in the brickwork, and passes all round and over the boiler. At the ends of the bottom case b^1 there are caps screwed on which can be taken off at pleasure in order to remove any refuse matters which may collect there.

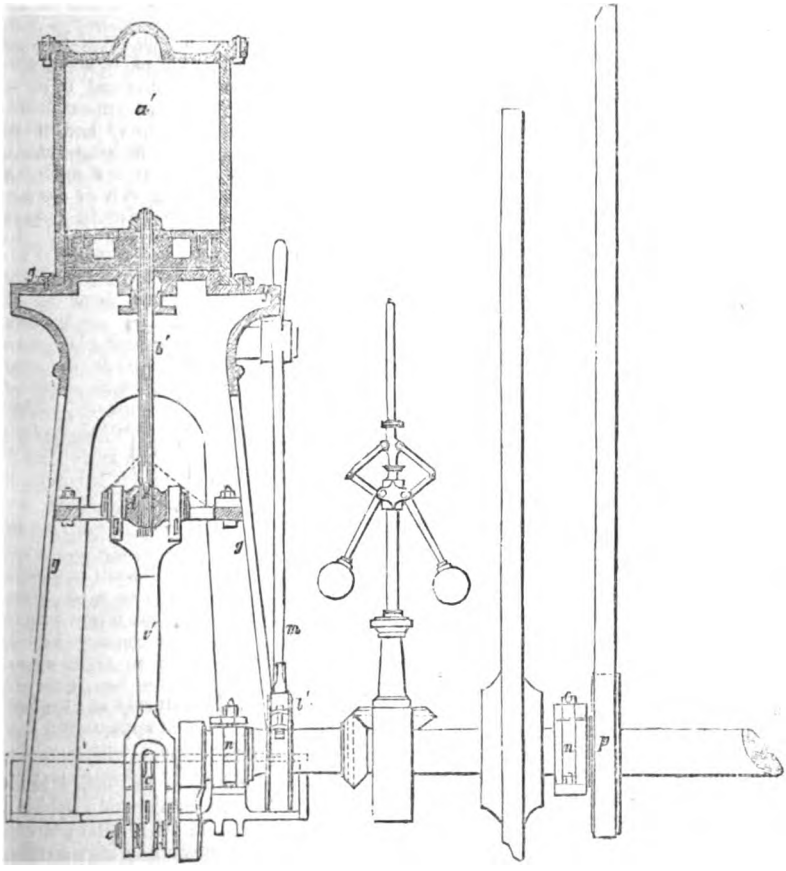
The steam is generated in such boilers with perfect safety, the whole of the parts being of small sectional area. It is demonstrable that on multiplying the pressure of the steam, even at 100 lbs. on the square inch into the surface on which it acts with a straining or bursting tendency, the force is vastly less than in low pressure boilers of the common kind, with a pressure of no more than 10 or 12 lbs. to the inch.

Regulating Damper,

To regulate the admission of air to the furnace, and consequently control the combustion of the fuel in such a manner, as to produce at all times an uniform emission of steam, and thus give steadiness to the engine, economise fuel, and avoid unnecessary strain upon the boiler, I employ an apparatus of the description represented in fig. 9. *t* is an air-vessel, and *u* a small cylinder beside it fitted with a piston, which is attached by a chain *v* to a cross-lever *w*, which is connected by another short chain to the damper: *r* is a tap which commands the passage into the air cylinder; *t* and *s* another tap attached to a pipe which leads into the top of the small cylinder *u* above the piston; *q* is a pipe which leads from the boiler to the two taps *r* and *s*. The action is as follows: The tap *r* is left open by the engineer until the pressure in the boiler has attained to the proper working point; in doing which it forces water (cold) from the boiler into the air-vessel *t*, so as to compress the air in that vessel until it attains a pressure equal to that of the steam. The tap *r* is then closed and the tap *s* opened, so that while matters are in that state no action can take place between the steam in the boiler and the compressed air in the vessel *t*, except through the medium of the piston of the small cylinder *u*. As soon, therefore, as any slight increase of pressure in the boiler arises it produces a corresponding depression of the piston in *u*, which pulls down

Digitized by Google

Fig. 7.



the chain *v* and lever *w*, and thereby closes the damper, which lowers the pressure of the steam in the boiler to the working standard; and when that takes place the preponderating pressure of the compressed air in the vessel *t* forces the piston of *u* up again, and therewith the chain *v* and lever *w*, which opens the damper. The water introduced to the cylinder *u* being cold allows of a leather piston being used, the friction attending which is small and uniform.

The Steam Chest.

The steam chest is placed within the chimney and is of small transverse diameter, but lengthened in one direction. The steam enters through the pipe *k*, and is conveyed thence to the engine by a pipe *m*, the mouth of which is carried to near the top of the chest, so that any water which may come along with the steam may fall by its own gravity down to the bottom of the chest, from which it is returned by a pipe *l* into the boilers. The evil effects of priming, which have been hitherto a great drawback from the advantages of all tubular boilers, are thus completely obviated.

(*To be continued.*)

Digitized by Google

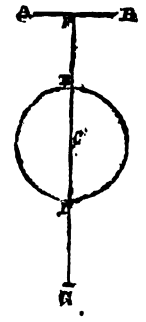
If a person were to examine an object placed at a proper distance for observation, and another person, having the same distinctness of vision, were to view it at a much greater distance, and a third person, having the same powers of eyesight, were to examine it through a microscope, and were each person to describe the object according to the impression which it had conveyed, their descriptions would all differ amongst themselves; and were they each to give their descriptions of the object, without stating the circumstances under which they had viewed and examined it, their descriptions would obviously form matter for dispute, not only among readers generally, but also amongst themselves.

Bishop Berkeley says, "Take an inch marked on a ruler, view it successively at the distance of half a foot, a foot, a foot and half from the eye; at each of which, and at all the intermediate distances, there shall be more or fewer points discerned in it. Now I ask, which of all these various extensions is that stated determinate one that is agreed on for a common measure of the other magnitudes?" In this instance, if the inch were viewed at the several distances by different persons having the same clearness of vision, its number of points would appear different to each observer, and were they each to describe the inch as it had appeared, it is quite clear that their descriptions would not agree; very probably each observer would maintain that the others were wrong, and that he alone was right.

What has been said, perhaps, renders it pretty manifest that before the observers can agree in their descriptions of an object viewed, they must be brought acquainted with the particular circumstances under which it has been respectively examined, and must modify their descriptions accordingly.

The simple theory of microscopes may be thus briefly explained. If an object be placed in the focus of a convex lens, and the eye be at a proper distance for vision on the other side, the object will appear distinct and erect, and it will be magnified in the ratio of the focal distance of the lens to the common distance of distinct vision, that is, about eight inches, or,—

Thus, suppose an object AB to be placed in the focus F of a small glass sphere, and the eye behind it in the focus G; the object will appear distinct and in an erect position, and it will moreover be increased in magnitude in the ratio of $\frac{4}{5}$ths of EI to eight inches. Let the diameter $EI = \frac{1}{10}$th of an inch, then $CE = \frac{1}{20}$, and $EF = \frac{1}{2}CE = \frac{1}{40}$, hence $CF = \frac{3}{40}$.



$\therefore \frac{3}{40} : 3 : :$ the natural size : the magnified appearance,

or $3 : 320 : : 1 : 106\frac{2}{3}$,

that is, the object is magnified nearly 107 times. This explanation applies to single microscopes; but it will be obvious from this simple example that a trifling difference in the power of the lens will very considerably increase or diminish the magnified appearance. The same remark applies, taking their complex construction into account, to the various kinds of compound microscopes which are generally used in philosophical inquiries.

A globular object, which is less than $\frac{1}{480}$th of an inch in diameter, is to most eyes totally invisible. An object which is $\frac{1}{480}$th of an inch in diameter subtends an angle of one minute at the distance of eight inches from the eye. No object, therefore, less than $\frac{1}{480}$th of an inch in diameter can be seen by *common eyes*. (*Encyc. Metrop. Optics*, 425.)

Digitized by Google

To the generality of eyes, the nearest distance of distinct vision is, as before observed about eight inches, called the *minimum visible*. Some eyes, however, can see small objects best at the distance of 6, 4, or even 3 inches; whilst others can see most distinctly at 12 or 15 inches.

Now supposing the above sphere to be used by each of these persons, then

$\frac{1}{6}$: 6 : : 1 : 90
$\frac{1}{4}$: 4 : : 1 : 53½
$\frac{1}{3}$: 3 : : 1 : 40
$\frac{1}{12}$: 12 : : 1 : 160
$\frac{1}{15}$: 15 : : 1 : 200

} the magnified appearance of the object.

From these very simple illustrations it will be obvious that a small object viewed by the same person through different microscopes will not appear to be the same; also, that if the same small object be viewed through the same microscope by two persons having eyes possessing different powers of distinct vision it will not appear alike to each observer. Hence if each observer describe the object as it appeared to him, their descriptions will manifestly differ. If the microscopes they employ be precisely of the same construction, and their eyes be exactly of the same formation, very probably their descriptions of the object viewed would agree: on the other hand, if their eyes are alike, and their microscopes differ, or if their microscopes be the same, and their eyes not alike, some modification must take place so that they may each view the object under the same circumstances, before their descriptions of it can possibly concur.

It requires no formal demonstration to prove that if either of the observers were to generalize upon his observations without any explanation respecting eyesight, instruments, &c., a theory resting upon such a basis would be altogether negatory. If, for instance, any substance has been examined, and alleged to be composed of particles of a certain form or kind, unless upon a proper examination it be found to be so made up, the allegation relative to its component parts is a matter of doubt or denial: hence such examinations, however scientifically and carefully made, can add little or nothing to our real knowledge of the constituent parts of bodies, unless the observers also minutely detail the process by which they were examined, and all the circumstances with regard to instruments, vision, &c., connected with the investigations; so that if the objects be viewed by other observers, with the same care and under the same incidents, they may appear to all alike. Unless this concurrence be general, any peculiarity must be attributed to eye-sight, instrument, &c. The same body similarly scrutinized must always appear the same; and it would be idle to assert that observers, who differ as to the form of the component particles of bodies, by such differences at all increase our knowledge of the real intrinsic nature of such bodies; their disputes are difficult to reconcile; they tend to impede rather than to accelerate science.

It is no easy matter to account satisfactorily for the striking discrepancies which occur in the descriptions of the constituent particles of matter, even when the authors of such descriptions are men alike accustomed to such examinations, and whose acuteness, probity, and talents are equally undoubted, unless these differences can be referred to some dissimilarity in the instruments employed, or to some unlikeness in the observers' powers of vision. But however honest and careful each observer may be, it is evident that their differences render their labours very nearly abortive. They do not advance knowledge. It is much easier to jump to the conclusion that they are all wrong than it is to ascertain which is right; especially if the groundwork of their descriptions be not fully and carefully explained.

My talented neighbour, Dr. Shapter, in his interesting address to the Medical Association, held at Leeds not long ago, relates a remarkable instance of this diversity of description:

Dr. Martin Barry had minutely investigated the blood corpuscles, and the conclusion drawn from his elaborate investigation was, that the red corpuscle is a primary nucleated cell, circular in form, flattened on its surface, and rounded at its edges, having a diameter ranging from about $\frac{1}{3500}$ of an inch to $\frac{1}{4000}$ of an inch.

Mr. Wharton Jones, in a paper read before the Royal Society, December 8, 1842, mainly with the view of combating some of the statements of Dr. Martin Barry, says, that the red corpuscle consists of a vesicle or cell with thick walls, but in a collapsed and flattened state, and having therefore a bi-concave

Digitized by Google

form, and, in consequence of its thick wall being doubled on itself, presenting under a microscope a broad circumferential ring, which is illumined or shaded differently from the depressed central portion according to the focal adjustment of the instrument.

The account of Mr. Addison, though in some respects similar to that of Mr. Jones, differs entirely as to the origin of the diversities of shade in the ring and centre of the corpuscle: he concludes that these appearances are due to the fact of the corpuscle consisting of two elastic vesicles, one within the other: Mr. Addison states the average size of these corpuscles to be $\frac{1}{3500}$ of an inch in diameter.

The reader may learn from Dr. Shapter's condensed summary on this subject, that Dr. Barry, Mr. Wharton Jones, Mr. Addison, Dr. Willshire, and Dr. Carpenter, all differ in some respects among themselves with regard to the form and component parts of the red corpuscle. When doctors so disagree it certainly is difficult to decide.

Undoubtedly Dr. Barry, Mr. Wharton Jones, and the other gentlemen mentioned, were alike solicitous to describe the object exactly as it appeared; each was equally anxious to advance science upon the basis of truth: how, then, may their very contradictory conclusions be reconciled? They cannot be all correct; but how may the origin of their various differences be discovered? In the absence of all information upon the mystery—it does appear to be extremely likely that they did not start fair; or, in other words, that they did not all view the objects which they describe, and about the appearance of which they so strangely differ, through the same microscope, or with the same power of eyesight; that is, that they did not examine the object under exactly similar circumstances. Taking the extreme minuteness of the object into consideration, very probably a small variation in the glass or eye is sufficient to explain many of the differences between the doctors. Such variation would evidently affect the appearance of the *thick walls* or *circles* of the corpuscle; for the reader must bear in mind that the red corpuscle, whether made of THICK WALLS OR CIRCLES is about TEN times less than the smallest object that can be seen by th common eye.

Mr. Coddrington, in his *Treatise on Optical Instruments*, mentions the object-glass of a microscope made by Mr. Carey, which shows with great distinctness every part of a large field of fine striæ on the scales of a moth's wing, which are not discerned at all with large microscopes of the ordinary construction made by the best opticians.

It is pretty clear, that an observer using this microscope, and another equally competent observer making use of another microscope, would differ in their descriptions of a moth's wing: one would assert that it had fine striæ, the other would maintain that it had nothing of the kind on it. Which observer would state the fact? Does the moth's wing actually exhibit striæ, or is there any peculiarity in the object glass which gives the appearance? Do microscopes always show things really in being, or do they sometimes treat us with appearances very like optical illusions! The oxyhydrogen microscope makes the animalcules in a drop of liquid appear of enormous size; it is said that a countryman once looking at them wished to be off lest they should come out. Here no doubt, "seeing was believing;" but the astonished observer did not think of the absurdity of such monsters being enabled to gambol in a drop of liquid.

Whether the fact quoted from Mr. Coddrington's book, or the remarks upon it, will suggest any explanation of the differences among the doctors, is a question which must remain unanswered: the enigma cannot easily be solved. The doctors themselves should so far agree as to set about tracing their disputes to their first cause. One fact is certain, the doctors' differences do not advance general knowledge even among the members of their own profession. Doctor Shapter's publication before referred to was written for the purpose of placing before the Association the exact state of medical science; with this view, having briefly stated the opinion of each theorist with respect to the red corpuscle, the doctor very justly says, "between this conflicting testimony it is difficult to decide, and the matter must be left for further investigation." Instead, therefore, of laying before the Association statements of settled and useful facts upon the subject, the doctor, with all his care and research, could only serve them with a string of

Digitized by Google

contradictions. Now, if the red corpuscle of the blood be made up of certain component parts of definite form, those parts and forms must appear alike to all competent observers, if examined under the same circumstances with regard to instrument and eyes. It is absurd to say their constituent parts are understood, if they do not so invariably appear the same. Dr. Shapter's conclusion proves that the conflicting opinions of the doctors render their labours almost useless: either in a scientific or a professional point of view, their differences establish nothing; but they excite doubts, not as to which is right, but whether they are not all wrong. One learned set of men say "aye," and another equally learned set say "no," and they leave it quite uncertain whether the ayes or the noes have it, or whether either ought to have it. But obviously no knowledge worth a straw can be based upon such a doubtful foundation.

That learned men should expend their valuable powers on such dubious speculations, without at the same time tracing their course so that others may track and follow them, is not only unaccountable, but, to a certain extent, it is mischievous. This opinion perhaps requires some explanation, and it shall be attempted without referring to another topic.

Dr. Barry has published several elaborate articles on *Embryology* in the *Philosophical Transactions*. The investigations have evidently cost the doctor immense labour; and they were considered so meritorious by the Council of the Royal Society, as to obtain one of their medals—the highest guerdon that a British philosopher can gain. In these essays Dr. Barry advanced the theory with regard to the red corpuscles of blood, which has been adverted to above. Mr. Wharton Jones, in the same celebrated publication, has taken the opposite side of the argument, whether to gain a prize or mere celebrity, does not appear; but, at all events, he manfully combats Dr. Barry's statements, and makes it very doubtful which is correct, or whether both may not be wrong. Now, the *Philosophical Transactions* being a national work of the highest repute, every scientific Englishman would see them if he could. There are lovers of science who may be fairly termed countryfied philosophers—men whose love for science is great, but whose pecuniary means are small. Many such men, by carefully husbanding their incomes, contrive to purchase the *Transactions* as a mental treat. Of course they read the *whole*—they cannot afford to miss anything; and they naturally infer that all they find therein is of the first water. The very laborious physiological essays referred to have filled a large part of many numbers. No doubt they are particularly interesting to professional readers; but to the sort of readers above mentioned, it requires a mind well made up to get through them. However great the thirst for knowledge may be, to many non-professional readers the wading through such masses of blood-corpuscles, arteries, &c., &c., is very like taking physic when one had rather not. But a reader of the description named, having gone through the task of reading those articles, and having, as he thought, added to his knowledge the fact that red corpuscles are of a certain formation, how very much annoyed he must feel in perusing a similar article in the next number to find, in strong terms, that his fancied acquisition of knowledge is all moonshine, —that blood corpuscles are not of the form first fixed on his mind, but of some other, or of no form at all! Is it not to be regretted that readers of this class should be entrapped by the repute of the publication thus to throw away their time and money? Had they been tempted to meddle with the lumber parts of physical publication, they would have no right to complain; but, unquestionably, the rulers of British science should have some regard for readers who buy books to read, and not merely to fill shelves. The writer has a strong fellow-feeling with this kind of readers; and he can speak positively as to the effect which such contradictory theories have on their minds: on this account, therefore, he trusts that the preceding strictures are pardonable. The suppositions, as to how those learned gentlemen may have arrived at their very opposite conclusions, are mere conjectures, and nothing more; but if they are not satisfactory to writers who philosophize upon bare seeing, they will perhaps feel the propriety of solving the puzzle themselves. If they do this, the writer's object will be accomplished. No attempt

Digitized by Google

to theorize has been made: the writer in some of his suppositions may be right, but that is a matter of indifference. It may be easy to show that many of his hypotheses are founded in error or misconception; but this also is of no importance. His aim is not that any one should take the trouble to prove his notions right or wrong, but to call attention to conflicting theories, the publication of which he thinks he has shown to be useless even to professional readers—and, certainly, they are of no kind of service to any one besides. It would ill become the writer, and be directly against his wishes, to speak lightly of the promoters of science: some of the learned doctors already named are justly celebrated for their scientific achievements. He trusts that they will continue their praiseworthy exertions; but at the same time he wishes to express a decided opinion that conjectural hypotheses on subjects entirely professional, however elaborate, would be more appropriate in publications altogether devoted to such discussions, than they are in works adapted and intended for general readers.

The question may be fairly asked, "Why should one of the learned professions be allowed to fill so large a part of the *Philosophical Transactions* with lucubrations which are altogether professional, whilst the labours of the other two professions, as they are termed, are excluded?" Would not a laborious essay on contingent remainders, or a very learned article occasionally on the notions of the ancient fathers, be just as philosophical, and quite as instructive, as such huge masses of discordant physiological matter? At all events, it would introduce variety. It seems unfair for physic to engross too much space to the entire exclusion of law and divinity. However, if the doctors will not concur in the fairness of this opinion, as a body they have the power to decide and act accordingly. The "M. Ds." form a very formidable phalanx in the Royal Society—those Roman numerals appear to have a strong, perhaps a natural kind of, affinity to stand before F.R.S. On this topic, Mr. Babbage, *Decline of Science*, page 187, says: "The honour of belonging to the Royal Society is much sought after by medical men, as contributing to the success of their professional efforts, and two consequences result from it: In the first place, the pages of the *Transactions of the Royal Society* occasionally contain medical papers of very moderate merit: and, in the second, the preponderance of the medical interest introduces into the Society some of the jealousies of that profession. On the other hand, medicine is intimately connected with many sciences, and its professors are usually too much occupied in their practice to exert themselves, except upon great occasions." No remark is made on these strictures; but it is an easy matter to count heads in the Royal Society's list of Fellows, and to count pages in its published *Transactions*.

In the case that has been discussed the doctors only agree to dispute; hereafter it is hoped, they will *start fair*.

What microscopic philosophizers see, or pretend to see, are realities or imaginary objects; they describe facts or fallacies. If they write about real and the same entities, their descriptions of them ought to be alike; and when they differ, strong doubts must arise as to which delineation is correct: and the reader, who is incompetent to repeat the necessary experiments to get at a decided proof, and who does not know enough of either of the disputants to pin his faith to what he asserts, naturally concludes that the whole is too imaginary to be of any service, or to establish any fact. Such labours, wherever or however published, if they were properly classified, must come under the denomination of exceedingly useless philosophizing, or very learned trifling—well adapted to disappoint the *countryfied philosopher*, and fit only to increase the bulk of a publication, without in the smallest degree adding to its credit or value.

In reference to the preceding article it has been observed to the writer, "How general and extensive is the *agreement* of observers as to the form, &c., of objects known only through the microscope, and what a vast amount of philosophical scepticism we must admit, if we reject all that is visible to the eye when attested by a lens."

It has also been remarked, "That the papers in the *Philosophical Transactions*, to which allusion has been made, ought not to be considered as professional; they are papers of scientific

Digitized by Google

(physiological) investigation, and memoirs on such subjects have always been admitted into the *Philosophical Transactions*, and into those of other scientific societies."

These observations do not exactly meet the object of the paper which they are intended to controvert. The *agreement* of observers has raised no question;—their DISAGREEMENT in their descriptions of the *same object*, especially in the *Philosophical Transactions*, was the point mooted. What is the reason of those differences is one of the topics discussed, and which microscopic theorisers are invited to explain. It is quite true that we must admit a large amount of philosophical scepticism "*if*" we reject all that is made visible by a lens; but who has advocated such rejection? The same object made visible by a lens, it is presumed, ought to appear alike to all observers, and their descriptions of it ought to agree: if not, why not?

No manner of doubt was intended to be raised as to whether such memoirs have been admitted into the *Philosophical Transactions* and other publications, but some stress has undoubtedly been laid on their utility. If they are not professional articles, under what category ought they to be placed? If the profession to which they particularly relate, can extract nothing satisfactory from them—how can they possibly promote science, or practically extend knowledge? And if they effect neither the one object nor the other,—the question, *Cui bono?* must occur, no matter how celebrated the publication that burthens itself with such imaginary dissertations.

Since the preceding paper was written, the Royal Society's singular bestowal of one of its medals on Dr. Beck's physiological article, has occasioned much discussion. According to the Society's own account of that memorable proceeding, the doctors not only manage matters of that kind pretty much in their own way, but they set the laws and regulations of the Society altogether at defiance, in order to crown the unpublished lucubrations of one of their professional compeers with a medal.

Admitting the published statements of some of the members of the Society, who attended the special meeting on the 11th of February last, to be correct, the conferring a medal on Dr. Beck was not only irregular and illegal, but thoroughly disreputable. For members of a Society, which assumes to stand at the head of English science, to confer its highest reward by a species of jockeyship, is a national disgrace. It is to be hoped that the Society, for its own credit, will prevent the recurrence of such an act, and hereafter severely punish any of its members who may have the temerity to attempt it.

Committees of members of the Royal Society, it seems, are appointed in each department of science. The occasional exercise of their functions, whatever these functions may be, can be guessed from what has been published in reference to Dr. Beck's medal. It is said the Committees determine what papers shall be printed in the *Transactions*. Whether the same kind of justice is exercised in selecting articles for publication as there is in shuffling for medals, is a question that cannot be readily answered—it is hoped not.

Might not the services of the Committees be rendered of some real value if, when essays on the same subject lead to directly opposite results, or flatly contradict each other, the members were cursorily to examine the principles of these essays, and call upon their authors for explanation, if any were wanted, so as to be able to add some elucidation of their own, showing briefly in what respects, and on what grounds, the speculators differ? Such an examination and commentary would not only be signally advantageous to readers generally, but their influence would extend even to the writers of the *Transactions*. "What author, indeed, but will write his best when he knows that his work, if it have merit, will immediately be reported on by a Committee who will enter into all its meaning, understand it, however profound, and, not content with *merely* understanding it, pursue the trains of thought to which it leads, place its discoveries and principles in new and unexpected lights, and bring the whole of their knowledge of collateral subjects to bear upon it."—(*Herschel on Sound, Encyclo. Metropol.*) Be this, however, as it may, clearly the filling large books with articles that are very like professional papers, quite contradicting each other, without one word of explanation,

Digitized by Google

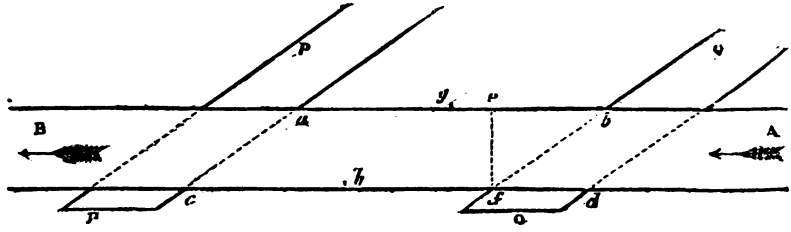
does not entitle the managers of such publications to the purchaser's thanks, nor does it afford very convincing proof of the Committee's usefulness.

Sir John Herschel, Mr. Babbage, and others have complained that science in England does not keep pace with the science of other countries. Supposing the complaint to be well founded, the question readily occurs, has the Royal Society done its duty to the nation by impartially encouraging the votaries of science? Does it at present, it may be asked, becomingly favour the cultivators of science, without distinction as to clique or clan? If it do not, can its rules and regulations be so modified as to become of national importance, and adequate to the absolute requirements of the age? If it be not thus adapted, and cannot be rendered so, must it not hereafter be considered a venerable piece of antiquity, which has worn out all its utility, and, in fact, become a sad nuisance, by filling up the position that an institution nationally useful ought to occupy? However, report states that improved rules and regulations will shortly be introduced into the Royal Society: it is hoped the rumour will prove to be correct. The Society is a national one: recent occurrences must have convinced every friend to British science that there is room for improvement in the general management of that body corporate; and he must feel solicitous that the Society should at once earnestly set about modifying its regulations, so as completely to remove all cause of *suspicion* or complaint. Some supervision and explanation of the kind above mentioned is strongly recommended to those members of the Society, who wish its labours to be as nationally beneficial as they ought to be high in celebrity.

J. J.

Exeter, July 12, 1847.

SKEW PIERS AND IRON GIRDERS.



Now that the attention of the scientific world is so much drawn to the fall of the railway bridge at Chester, every consideration connected with the subject becomes interesting.

It is a skew bridge with three openings of 98 feet each. It was proved before the Coroner by witnesses who observed the fall, that when a heavy engine passed over the bridge, the girders deflected to the extent of 5 inches in the centre.

In the above plan, *a b* and *c d* represent a pair of girders supported by the oblique piers P P and Q Q. As an engine passes from A to B, when it gets to *e f* one side rests on the pier Q, while the other, at *e*, is on the girder *a b*, which has begun to deflect with its weight; and until it reaches *g* the centre of the opening *a b*, the wheel on *a b* will be lower than the wheel on *c d*. Having passed the centre of *a b*, the wheel on *a b* begins to rise, while that on *c d* continues to sink till it reaches *h*, the centre of *c d*; and from thence to the pier P, the wheel on *a b* will be the highest. If, as at Chester, there be a second and a third opening, the same process of the sides being alternately raised and depressed will follow at equal intervals. It is difficult to know exactly what is the period of oscillation of a locomotive engine, but

Digitized by Google

if this wheel in passing from its lowest to its highest point coincide with the time occupied by each, it could not fail to have a great effect in increasing alternately the pressure on the two girders.

The fracture at Chester occurred in the centre of the third girder; that is, at the point where for the third time in regular succession the engine was at the extreme point of its oscillation towards the side that broke. It would be too much to say that this occasioned the fracture, but it may have been among the aggravating causes that led to it; and it is well worth considering, with reference to the application of girders to skew bridges of *many openings*.

A train travelling at 30 miles an hour takes two seconds to pass over 100 feet. One cannot speak as to the time in which an engine of a given construction would oscillate, but if the law governing the vibration of bodies above the point of support be the same that exists as to pendulums, an engine having its centre of oscillation 39 inches above the rail would vibrate in one second; and consequently its oscillations would tally exactly with the swingings occasioned by the deflections and risings of the girder when travelling at 30 miles an hour. Should the centre of oscillation be, as it probably is, considerably more than 39 inches above the rail, the same effect would be produced when the rate of travelling was less than 30 miles an hour.

P.

Chester, July 22, 1847.

MR. DREDGE'S BALANCE BRACKET GIRDER.

Sir,—In the "Investigation of the Strength of Cast Iron Beams, or Girders, employed in the Construction of Bridges," which you have done me the favour of inserting in the last number of your journal, I endeavoured to demonstrate the advantages of causing the girder and tensile-beam, to act in unison. Will you now permit me to add that it was with a special view to a union of these advantages that my father designed the balance bracket girder, described in a preceding number (1251) of your journal.

The advantages proposed for this form of girder are: 1st., That by tapering from the abutment, and making the fulcrum there instead of, as is usually the case, at the centre of the girder, a great deal of material is discharged from the structure, which would otherwise act with an effective leverage, proportional to the length of the beam, to the production of a great deal of strain at the centre, tending to facilitate the destruction of the bridge. Thus, if P_2 = the weight of material discharged by this form of girder, and p = the distance of the centre of gravity of the material and the abutment; then $P_2 p$ = the effect which the material discharged would have in producing fracture; and consequently by getting rid of the material the bridge will be strengthened to this extent.

2nd. The material of the bridge is economized to the extent of the quantity taken away. Or, which is perhaps better, by placing the material taken from the centre of the girder in the bracketed form, the strength of the bridge is vastly increased.

3rd. By reason of the form of girder, and of the fulcrum being immediately over the fixed abutments, the lateral action from the compressive force is prevented,* and the action of a train in passing over would not be so likely to produce that motion which is so liable to derange the construction.

4th. That by reason of the tensile bars acting at some distance below the points to which the ears are attached to the girder, sufficient latitude is allowed for the difference of action in wrought and cast iron, under pressure. Whilst the tensile rods being carried back by means of short horizontal bars, the whole of the force is taken away from the upper edge of the beam.

The equations and calculation of the balance bracket girder are made similar to those in the paper published in your last number; but as I think the subject worth further consideration, I may be tempted, in some subsequent number of

* In the "Investigation" it is stated that the tensile flange should be much larger or broader than the compression flange, and that experiments have proved the difference to be in the proportion of 6:1. It would, however, be dangerous in practice to adopt the extreme of this theory, especially in bridges of long dimensions, from the fact of a compression line under pressure being so liable to become crooked, and thus lose its strength from lateral deviation. More material must, therefore, be placed in the compression flange, than is absolutely necessary to resist the compression, or to stiffen that part of the beam, and prevent lateral deviation.

Digitized by Google

your journal, to trouble you with a mathematical investigation of it.

I am, Sir, yours, &c.,
W. DREDGE, C. E.

HORÆ ALGEBRAICÆ. BY JAMES COCKLE, ESQ., M. A., BARRISTER-AT-LAW.

(Continued from page 15.)

II. UNLIMITED PROBLEMS—THE EXERCISE—SELECTION OF RESULTS.

The following two equations,—

$$5x+7y=29 \ldots\ldots\ldots\ldots (1)$$
$$9x+15y=2 \ldots\ldots\ldots\ldots (2)$$

completely determine x and y; and these quantities admit of no other values than those given below (*a*). But if we had only *one* of the above equations proposed for solution,—the equation (1) for instance,—all that we could do (without introducing other conditions) would be to determine x in terms of y, or *vice versâ*. We may however introduce any other condition that we please provided only that it be not inconsistent with (1). Thus we may make (2) the second condition; or we may give to x any values that we please, and so arrive at corresponding values of y, or *vice versâ*. In fact, since we may vary as we please the second condition, we may obtain an infinite number of solutions of (1); and, considered with reference to that number, this species of problem may properly be termed an *infinite*, or *unlimited*, problem. Again since the equation (1) would, of itself, only enable us to find one of the quantities (x and y) in terms of the other, one of those quantities will remain undetermined; and, hence, we may apply to this kind of question the term *undetermined* or *indeterminate*. The latter is the term in use.

But a problem is often called "indeterminate" which is not so in the above sense of the word. Thus;—to the equation,

$$5x+7y=29 \ldots\ldots\ldots\ldots (1)$$

let there be attached the condition

x and y are positive integers.. (3)

then $x=3$ and $y=2$ are the only (*b*) values of x and y which satisfy (1) and (3) simultaneously. Hence the problem is as *determinate* as when we had to satisfy (1) and (2) simultaneously. And yet, the second condition (3) not being in the present case given in the form of an equation between x and y, the problem is called an "indeterminate" one. So that that term seems rather to have reference to the form of the second condition than to the real nature of the question as defined by the two conditions (1) and (3).

Had it been proposed to satisfy simultaneously the conditions

$$9x-15y=2 \ldots\ldots\ldots\ldots (2)$$
x and y are integers..... (3)

we should have found that *no* values could be assigned to x and y such as to fulfil them (*c*). And yet this question, involving only one condition expressed in the form of an equation between x and y, is, in its form, an indeterminate one. The nomenclature of this part of Algebra seems to be defective; and it is clear that the use of the term *unlimited* instead of indeterminate would be equally open to objection.

The term *Diophantine Algebra* is sometimes used as identical with "indeterminate analysis" (*d*); and sometimes the word *Diophantine* is applied to "a species of unlimited problems, principally respecting square and cube numbers" (*e*). On the other hand, some writers do not use the word "Diophantine" in connection with this species of question (*f*).

Without going further into the subject of Nomenclature at present, I shall proceed to offer a few remarks on the Exercise which I gave at pages 14—15. Suppose, then, that we omit the words "*by unity*" which occur in the third line of that Exercise (*g*); and for its three last lines substitute the following:

Give a solution for the case when the number of beasts bought by the third farmer is the square of the number purchased by each of the others.

(*a*) These values are $x=\frac{449}{138}$ and $y=\frac{251}{138}$. The numerators of these fractions are prime numbers.

(*b*) Wood's *Algebra* (10th ed. 1835) page 296, Ex. 1.

(*c*) See an English translation of EULER'S *Elements of Algebra* (London, Johnson and Co., 1810, 2nd. edition), vol. ii., pages 19—20, arts. 22 and 23.

(*d*) Ibid., vol. ii., p. 245, first paragraph of the "Advertisement" to LAGRANGE'S *Additions* to the work mentioned in the last note.

(*e*) Bridge's *Algebra*, (6th ed. 1826) page 171, Art. 152.

(*f*) It is not used in the Chapter "On Unlimited Problems" in the 10th ed. of Wood's *Algebra*; nor in the corresponding Chapter of Kelland's *Algebra*.

(*g*) *Supra*, page 14, line 6 from the bottom.

Digitized by Google

Let x=number of beasts bought by the first (and second) farmer,

$x-y$=price paid for each beast by the first farmer,

x^2=number of beasts bought by the third farmer;

then at first sight this would appear to be a purely indeterminate question,—one defined by a single equation between two undetermined quantities x and y. With respect to x indeed the number of solutions is *unlimited*; but with respect to y we are restricted to the values which satisfy the equation

$$2-y^2=1;$$

and are consequently thrown back upon the Exercise as announced at pages 14—15, in which, if we assume that x^2 is the number of beasts bought by the third farmer, we shall arrive at an *identity* (*h*) and so attain the required result.

Now, on looking at the Exercise as originally announced, we see that if

$f(x)$=total number of pounds paid by the second farmer

then $f(x-1)$ and $f(x^2)$ will respectively represent the total number of pounds paid by the first and third farmers; and the Exercise is connected with the functional equation

$$f(x-1)f(x)=f(x^2) \ldots\ldots\ldots (4).$$

It may perhaps interest some of your readers if I give a solution of the simplest case of this equation—which in fact corresponds with the question involved in the Exercise.

Assume that $f(x)$ is of the form

$$\alpha+\beta x+\gamma x^2+\&c.,$$

and first let

$$f(x)=\alpha+\beta x$$

and consequently

$$f(x-1)=\alpha-\beta+\beta x$$
$$f(x^2)=\alpha+\beta x^2,$$

then the condition (4) conducts us at once to the following,—

$$\alpha(\alpha-\beta)=\alpha \quad , \beta^2=\beta, \beta(2\alpha-\beta)=0$$

from which we see that, if we reject zero as a value of β, the function f cannot be of the form last assumed; hence, let us suppose that

$$f(x)=\alpha+\beta x+\gamma x^2$$

then $f(x^2)=\alpha+\beta x^2+\gamma x^4$ and

$$f(x-1)=\alpha-\beta+\gamma+(\beta-2\gamma)x+\gamma x^2$$

and since γ must not vanish we obtain at once

$$\gamma=1$$

also, rejecting $\alpha=0$, we have

$$\alpha-\beta+\gamma=1 \text{ or } \alpha-\beta=0,$$

and the condition given by the terms in x^2 is consequently, since $\alpha=\beta$,

$$1-\alpha+\alpha^2=\alpha \text{ or } (\alpha-1)^2=0$$

hence $\alpha=1$; and with the above values of α, β, and γ, the co-efficients of x and x^3 on the left hand side of the development of (4) become zero. And the simplest solution of the functional equation (4) is

$$f(x)=1+x+x^2$$
$$=x(x+1)+1$$

the function which occurs in the Exercise.

I now propose to make a few remarks on the subject of *irrational* equations and to apply to the results deduced from them the same principles of selection (which we have already found to be of some service,) as in other cases (*i*). This is a question of, perhaps, some little interest since the first instance in which we have found those principles entirely at fault is one in which y is given as an *irrational* function of x (*vide supra* page 14).

Let there be given (*j*)

$$x+\sqrt{5x+10}=8 \ldots\ldots\ldots\ldots\ldots (5)$$
$$\therefore \quad 5x+10=(8-x)^2$$
$$=64+16(-x)+(-x)^2$$
$$\text{or } (-x)^2+21(-x)=-54$$
$$\text{or} \quad -x+\frac{21}{2}=\sqrt{(+1)^2\left(\frac{21}{2}\right)^2-54}$$
$$\therefore x=\frac{1}{2}(21-15)=3$$

the true result; the other value of x is 18.

Let there be given (*k*)

$$3x+\sqrt{2x-2}=7 \ldots\ldots\ldots\ldots\ldots (6)$$
$$\therefore \quad 2x-2=49-42x+9x^2$$
$$\text{or } 9x^2-44x=-51$$
$$\text{or } \left(3x-\frac{22}{3}\right)^2=(-1)^2\left(\frac{22}{3}\right)^2-51$$
$$\text{or} \quad 3x-\frac{22}{3}=-\frac{5}{3}$$
$$\therefore x=1\frac{8}{9}$$

the true result; the other value of x is 3.

(*h*) If we make x=number of beasts bought by the third farmer we shall also have $x=-(x^2+1)$ for a solution; but this last is not an available result.

(*i*) *Supra*, pages 13—14; vol. xlvi., pages 491, 516.

(*j*) Wood's *Algebra* [Lund's (12th) ed. 1845] page 113; 10th edition, page 80.

(*k*) Ibid. page 128 of Lund's Edition.

Digitized by Google

But $x=18$ is not a solution of (5) nor is $x=3$ a solution of (6). These latter values belong to the equations formed from (5) and (6) by changing the sign prefixed to the radical from positive to negative (*l*). But when *both* the values of x belong to *one* of the related equations a difficulty arises; thus, let (*m*)

$$y+\sqrt{10y-71}=5 \quad . \quad . \quad . \quad . \quad (7)$$

the solution of this equation obtained in the same manner (*n*) as those of (5) and (6) is

$$y=8$$

a value which does not satisfy (7). In fact both this value and the value $y=12$ belong to the related equation

$$y-\sqrt{10y-71}$$

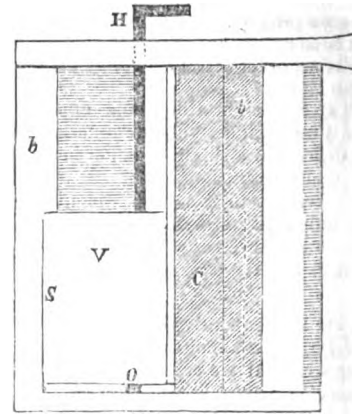
which is satisfied by each of them (*o*). I shall take another opportunity of resuming my remarks on these equations, and in the meantime would advise those who take an interest in discussions of the present subject to consult a paper by HORNER (consisting of a letter to Professor Davies) published at pages 43 *et seq.* of vol. viii. of the *Philosophical Magazine*, (Series iii.). The learned Editor of the last edition of WOOD's *Algebra* has fallen into an oversight in treating a part of the subject of irrational equations. The error (which occurs in the first paragraph page 129) originates in a fallacy, the nature of which was very clearly pointed out by the illustrious HORNER in the *Philosophical Magazine* (*p*).

(*To be continued.*)

Note.—In I. of the *Horæ Algebraicæ* (*supra* page 13) I have made the references in the notes wrongly. The reader will be pleased to substitute for "*Anis*" the correct reference, which is "vol. xlvi."

IMPROVED LOCK GATES.

Sir,—In number 1246 of your Magazine is a description of Lowthorp's wicket-gate for canal locks. While using the same principle in the construction represented in the following sketch, I submit that it is employed with greater simplicity and effect.



The figure represents one gate of a lock, viewed from the lower level. *b b* are two main beams; V is a flat sluice turning horizontally on an axis through its centre; it abuts on the outside of one beam and the inside of the other, and is so hung that the fluid pressure is greater on one side of the axis than the other. The pressure then being upwards the sluice will rest in the position represented. Now to open this valve there is a chamber C formed like a box, the water-tight lid of which is that part of V which is pressed against it. If we turn a cock and so let the water pass into C, it is plain that the pressure on this lid will be the same on both sides, and the fluid pressure on V will be greater on the side S of the axis, and will thus open the sluice. When the water rises to the same level inside and outside of the lock, the valve V becomes free and may be returned to its place by a slight force at the handle H; the four-way cock being turned to empty the chamber C, and bring the whole (as the water sinks) to its original condition. The completion of further details will be readily suggested to any mechanical mind, but the formation and the practical use of this sluice appear to me devoid of complexity.

I am, yours, &c.

JOHN MACGREGOR.

Battersea, July 16.

(*l*) WOOD, 10th ed., p. 81; Lund's ed., pp, 113, 128.

(*m*) This is a simpler form of the equation given at line 6 of page 128 of Wood's *Algebra* (12th ed.).

(*n*) Although there is a slight difference in the manner in which (5) and (6) are solved, yet the principles involved are essentially the same.

(*o*) WOOD, (Lund's ed.), p. 128.

(*p*) *Vide* pages 188 *et seq.* of vol. v. and 43 *et seq.* of vol. viii. of the third Series of that work.

A QUESTION FOR "A. H."

Sir,—I suspect that I have caught "A. H." napping; but shall forego further observations upon *dormitat Homerus*

Digitized by Google

until it may suit his convenience to explain more fully the principle laid down by him in the first column of the fourth page of your current volume, and comprised in the fortieth and three following lines, and to answer this question, "Supposing combustion as in common air, would a rocket ascend in vacuo?"

I am, &c.

JOHN MACGREGOR.

Battersea, July 16.

EFFECT OF PREMIUMS—ROYAL AGRICULTURAL SHOW.

"None like to see their own works surpassed, and particularly do they dislike to have them adjudged to be so, and by, perhaps, sometimes prejudiced or incompetent persons."

The Eureka—Vide ante page 65.

Sir,—I know not whether the Northampton judges were desirous of adding the weight of their practical testimony to the "Hint from Brother Jonathan," respecting the evil tendency of *premiums*, from which the above quotation is taken. Had such been their object they could hardly have accomplished it more effectually than by their extraordinary decisions and adjudications upon the relative merits of the numerous ingenious implements submitted to their examination at the recent meeting of the Royal Agricultural Society. One, out of many flagrant cases has amply revenged itself, by the very proper and spirited Resolution which was agreed to by some of the most talented of the Exhibiters,—a copy of which appears in your last number (page 114). The important character of the machine, the considerable amount of premium, and the manifest injustice of the award, rendered this a proper case for public animadversion.

Unfortunately this was by no means a solitary case of injustice, as the greatest dissatisfaction prevailed, generally, at the manner in which the premiums were awarded. The evil appears to have arisen as well from the prejudice, as from the incompetency of the judges; their own incompetency, I believe, they admit—upon the other point little difference of opinion prevails.

Having myself, on this occasion, been amongst the number of those whose lot it was to cast pearls before swine, my attention was naturally directed to the conduct of the judges, whose favours were evidently distributed among a small clique of "regular customers" (*i. e.* persons who follow the Society annually to all parts of the kingdom), while new comers, whatever the novelty or merit of their machines, stood but little chance—especially with men who only profess to be excellent judges of,—Horse and Hog's flesh!

In endeavouring to make such a distribution of the good things at their disposal among their old friends and patrons, as should keep them all in good humour, the judges have most notably failed.

It was stated that in one instance, feeling themselves somewhat embarrassed how to decide, the judges resorted to a common, though not very respectable expedient, and, by tossing up a halfpenny, solved the difficulty! A potato washer won the *toss*; but lost the *prize*,—the judges afterwards discovering that they had no prize left at their disposal!

In the "New Implement" (a Farmer's Fire-engine) which I exhibited to the Northampton Meeting, merit was claimed for, among other advantages, extreme portability, non-liability to derangement, facility and certainty of action, efficiency, and cheapness; in all of which respects it was without a rival. The judges put in competition with the foregoing an old implement, which has been exhibited year after year, displaying no particular novelty or merit, but which they thought worthy of a silver medal! At my earliest convenience I propose to lay before your readers a description of my new engine, with full faith in their ability to appreciate, and honesty to acknowledge merit wherever it exists. I may perhaps be permitted to say that the engine was greatly admired and warmly eulogized by many of the nobility and gentry visiting the exhibition.

Although somewhat personally interested, these remarks are penned solely on public grounds, for one thing I think is certain, the Royal Agricultural Society must either discontinue the award of Premiums, which is, after all, as brother Jonathan states, a practice "more honoured in the breach than the observance;" or, they must appoint impartial and competent judges to preside over the several distinct departments of the Show.

Let skilful graziers sit in judgment upon fat sheep, pigs, &c. Let practical farmers decide upon the respective merits of ploughs and harrows; but let engineering implements be subject to

Digitized by Google

the examination of engineers of known talent and impartiality.

Much mischief has doubtless been perpetrated; but the *public* are, after all, the real judges, and, by their discriminating selection, mark their thorough contempt for the adventitious distinction of "PRIZE IMPLEMENTS."

I am, Sir, yours, &c.,
WM. BADDELEY.

19, Alfred-street, Islington,
August 2, 1847.

SIBLEY AND RUTHERFORD'S EARTHWORK TABLES.*

The name of Mr. Sibley—though not unfamiliar to London circles, as that of a gentleman in extensive employment, and sound practical knowledge—is probably new to the scientific world at large. Not so, however that of his colleague, Mr. Rutherford, who enjoys a European celebrity both as a profound mathematician and an able calculator. His computation of the circumference of the circle to 208 decimal places, is a work without a parallel. We have heard it styled an affair of mere labour; but this is to underrate it vastly—for, without the employment of the most refined artifices, it would have assuredly transcended all human power—all human patience. The fact of Mr. Sibley's being associated in the present undertaking with a gentleman of Mr. Rutherford's high standing, may be safely accepted as evidence sufficient of his also possessing talents deserving of more than a mere local reputation.

No one knows better than Mr. Rutherford how to bring the higher mathematics to bear upon the practice of calculation; and, therefore, it was with no small degree of satisfaction that we read the announcement of this set of tables as being computed and arranged with his assistance, and (we presume) under his general superintendence. This is another instance of the *practical tendency* of mathematical minds in our own day, and upon which we have already made some remarks in a review of Mr. Bashforth's Tables (p. 15). We hope to see this tendency still further developed amongst scientific men, and that the *curiosities* of mathematics will be merged in inquiries that possess more or less *social utility*.

We presume that these tables have been calculated in duplicate, which, indeed, is the principal advantage to be derived from two persons being employed upon them. In addition to the security afforded by two independent computations by different persons, the authors state that they have verified them by "the method of differences to three places of decimals, and then tabulated to the nearest unit." We may, therefore, trust with implicit confidence to their accuracy.

The tables are computed for all the usual slopes, with a central width of 33 feet, and an additional table for the cases of all widths from 23 to 43 feet. A simple rule is given for obtaining the content for *all slopes*; so that the tables are, in reality, applicable to all probable widths and slopes of the cutting. The authors have rejected all adapting formulæ (which they appear to consider as mere petty excuses for direct calculation), under an impression that, however ingenious such transformations may be, they are incompatible with that accuracy and certainty of result which is so essential to all practical processes. Nor is it a slight improvement upon all preceding methods, that the *entire content* of a chain of the cutting is taken out of the tables by inspection, instead of requiring two numbers to be taken from separate tables, and added together. Not only is time saved, but a fruitful source of inaccuracy removed thereby. The tables themselves are as simple and easy of use as a table of logarithms, requiring only two arguments (the depths at each extremity of the chain) for giving the required content of the chain-length of the cutting.

These tables appear to us not only adapted to the immediate purpose of determining the actual content of work already done;

* Tables for Estimating the Contents in Cubic Yards of the Earthwork of Railways and other Public Works. By Charles K. Sibley, C. E., Assoc. Inst. C. P., and William Rutherford, F.R.A.S. Royal Military Academy, Woolwich. Longmans: 1847.

Digitized by Google

but to be infinitely better calculated than the rough processes usually employed, to enable an *unimpeachable* estimate of work *to be done*, to be laid before Parliament, when its sanction is required for any public undertaking. Every one conversant with the parliamentary history of railways knows the importance of this; and too many to their bitter cost.

The nature of the tables will be apparent from the following formulæ from which they have been computed: the first three for all values of a and b from 0 to 60 feet, with a central width of 33 feet:

I. $\frac{22}{7}(a^2+ab+b^2)+\frac{121}{3}(a+b)$.

II. $\frac{11}{9}(a^2+ab+b^2)+\frac{121}{3}(a+b)$.

III. $\frac{44}{27}(a^2+ab+b^2)+\frac{121}{3}(a+b)$.

IV. $\frac{11}{9}(a+b)$.

The last is the content of the central part, one foot in width, for the purpose of increasing or diminishing the previous tables for all widths of the central part of the cutting.

We had intended to give the investigations of these formulæ; but they are really so simple as to render it unnecessary, and we therefore omit them.

In conclusion we most cordially recommend these tables to the use of the profession, as fulfilling the conditions of accuracy, simplicity, and applicability in as great a degree as we think it likely these conditions ever can be fulfilled.

P. S.—In our review of Mr. Bashforth's Table, already referred to, we had overlooked (as it is evident that able mathematician had himself done) that his method does in no case apply to the depths registered in his table—at least, in the ordinary sense of the word "depth." His depth is estimated not to the road itself, but to *the intersection of the slopes below the road*. To take an instance: Suppose the slopes equal and 1 to 1; then the depth of the point from which Mr. Bashforth measures is, for a central part of 33 feet, just 16½ feet below the road; thus reducing his 65 feet table to 48½ feet. We mention this with no intention to detract from the value of Mr. Bashforth's table, nor with the slightest wish to modify in the slightest degree the expression of our estimate of the ability displayed in its composition; but simply to apprize those who use it, of a circumstance that might, if unobserved, lead to an inaccurate estimate.

IMPROVEMENT IN RAILWAY BUFFERS.

Sir,—I have perused with much interest the communication of Mr. Sutton to the Editor of the *Sun*, dated 20th of June, 1845, to which he referred me for a description of my concave and convex buffers which appeared in a recent number of your excellent Magazine. I am not inclined to relinquish my right of invention in consequence of anything appearing in the said letter, and it must be evident to your readers that Mr. Sutton's plan is not identical with the one I have had the honour of suggesting through the medium of the *Times* and your Journal. He says, "*If these buffers are furnished with a plug and key sort of adjustment they may, when a severe shock takes place become firmly keyed or locked into each other, and thus the whole line of carriages, at least those which are in the vicinity of the shock, will become as one body immovable, no running over each other or overturning, as they are as one carriage firmly united with the buffers, but which may be instantly disconnected by suitable gear.*" Now, Sir, the difference consists in this, that in Mr. Sutton's arrangement the buffers become firmly locked in one another whenever a collision takes place, and are in every instance to be disconnected by hand, &c. An arrangement of that nature would not answer the purpose, as any one conversant with railways can testify. If the carriages were to become locked every time the buffer springs were acted upon, it would be necessary to have a guard to attend every buffer. Now, in my plan there would be no necessity whatever for any mechanical arrangement more than having *concavity* to meet *convexity*. The buffers would be released and locked according to the disposition of the train. That such will be the plan adopted ultimately I have every reason to believe, and I feel assured that it will prove superior to the plan now in use, and thereby diminish, to some extent, the risks of acci-

Digitized by Google

dents in the case of sudden and violent collisions.

I am, Sir, your obedient servant,

O. ROWLAND.

July 31, 1847.

AERIAL NAVIGATION.

Sir,—I had intended to make a few remarks upon the impracticable aërostatic plan of Mr. Pitter; but I find those of your correspondent "Argus," at page 106 of your last Number, so pertinent, that I will not trespass on your space with vain repetitions. In reviewing past attempts, however, "Argus" refers to various difficulties in the way of directing balloons or aërostats, which certainly did exist in all the schemes hitherto submitted for that purpose. They are not, however, insurmountable; and if "Argus" will refer to a communication of mine, written eleven years ago (vide *Mech. Mag.* No. 689, vol. xxvi., p. 39), he will see that, while I perfectly agree with him as to the principles upon which aërial navigation must inevitably depend, I profess to have perfected such an improvement in the form and arrangement of the aërostatic machinery, as to render suitable propelling power available for its direction.

The power of propelling vanes was established by Tatum, and publicly shown in his lectures, some thirty years ago, and more recently at the Polytechnic Institution, by Mr. Green; but no one has shown how this known fact can be made applicable to the purposes of aërial navigation.

So long as the public are content to pay their money to gaze at balloons, as a species of puppet-show—increased in interest in proportion to the buffoonery or fool-hardiness of the aëronaut—we shall look in vain for any practical improvement in the *science* (?) of aërostation.

In conclusion, I would beg to say, too much importance cannot be given to the suggestion of "Argus," for adapting springs to the cars of balloons, to obviate the violence of the shock on striking the ground. The best form of spring would be a series of air-cushions, which, laid upon strong net-work, might form the floor of the car, covered by a piece of oil-cloth as a protection; these, in the event of a rapid descent, would effectually avert unpleasant consequences. No other elastic material could be employed, without an objection arising to its weight.

I am, Sir, yours, &c.,

WM. BADDELEY.

29, Alfred street, Islington,
July 31, 1847.

QUESTIONS IN FRICTION.

Sir,—I have no doubt but answers to the following questions will interest many of your scientific readers as well as much oblige yours truly,

A CONSTANT READER.

1st. Taking 8 lbs. per ton as the friction of a Railway Carriage, the wheels rolling, what would the friction of the same carriage amount to per ton with the wheels all sliding?

2nd. Does the number of wheels affect the question, whether 4 or 6?

3rd. Is the friction increased by the increase of rubbing surface, the weight remaining the same?

4th. Is the momentum of a locomotive as readily destroyed by the driving wheels revolving the reverse way (the engine still advancing by momentum), as if the driving wheels were sliding?

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 118.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

Andrew Meikle, of Knowsmill (East Lothian, North Britain), engineer and machinest: of a mill or machine for separating corn of all kinds from the straw, which machine is capable of being worked either by cattle, wind, or water, or any other power, whereby the corn may be separated in a less time and in a more effectual manner than by threshing. Cl. R., 28 Geo. 3, p. 1, No. 1. April 9, 28 Geo. 3; April 29, 28 Geo. 3, 1788.

Edward Troughton, of Fleet-street, mathematical instrument maker: of a new method of framing (composed of double parallel flat bars connected by cocks or pillars) to be used in the construction of octants, sextants, and quadrants of every denomination, and all other nautical and astronomical instruments whose limb or limbs is or are formed of a circle, or any part of a circle. Cl. R., 28 Geo. 3, p. 2, No. 2. April 1, 28 Geo. 3; April 28, 28 Geo. 3, 1788.

John Tencate, of Great Mary-le-Bone-street (Middlesex), engineer: of a horse pump calculated to raise from ten to one hundred hogsheads per minute, on the principle of a fulcrum balance worked by a cas-

Digitized by Google

ter wheel, performing a double attraction in the same revolution. Cl. R., 28 Geo. 3, p. 3, No. 8. May 5, 28 Geo. 3; May 14, 1788.

William Fulton, Broommuir, Airshire, manufacturer: of a new method or art of using and working pumps, as well on board of ships as on land, rubbing boards used in bleaching, and all other mechanical machines, or engines, of similar natures or constructions, by means of a cylinder (grooved) with its apparts. Cl. R., 28 Geo. 3, p. 4, No. 3. May 23, 28 Geo. 3; June 23, 28 Geo. 3, 1788.

James White, of Holborn, Engineer: of certain new improvements in mechanic motion applied to, and tending to ameliorate all kinds of clocks, watches, and time-pieces, jacks for roasting, cranes for raising heavy weights, and other purposes. Cl. R., 28 Geo. 3, p. 4, No. 2. May 20, 28 Geo. 3; June 19, 1788.

Francis Blaikie, of Glasgow, merchant: of an invention of an ingredient to be used as a substitute for gum in thickening of colours for printing (linen, calico, &c.), which will answer all the purposes of that article at a much more reasonable rate. Cl. R., 28 Geo. 3, p. 4, No. 1. June 11, 28 Geo. 3; July 4, 1788.

James Tylee, Marylebone, shoemaker: of a shoe slipper, and buckle to be affixed thereto and worn therewith, on a new construction, which will sit neater and easier than any hitherto discovered. Cl. R., 28 Geo. 3, p. 5, No. 2. June 30, 28 Geo. 3; July 28, 1788.

William Hanscombe, citizen and saddler of London: of an invention on a mathematical principle for roasting a great number of joints of meat, fowls, &c., horizontally and vertically. Cl. R., 28 Geo. 3, p. 6, No. 11. Aug. 15, 1788; Aug. 22, 28 Geo. 3, 1788.

Charles Lewis Ducrest, of Jermyn-street, Westminster: of an invention of making paper for the building of houses, bridges, ships, boats, and all sorts of wheel carriages, sedan chairs, chairs, tables, and bookcases, either entirely of paper, or wood and iron covered with paper. Cl. R., 28 Geo. 3, p. 6, No. 3. Aug. 12, 28 Geo. 3; Sep. 9, 1788.

Henry Cook, of Wapping, spunge-maker: of a new invented elastic spunge, for spunging great guns, and other fire-arms, which is not liable to be damaged by water or vermin, and will last considerably longer than any spunge heretofore constructed or used. Cl. R., 28 Geo. 3, p. 6, No. 2. Aug. 26, 28 Geo. 3; Sep. 26, 1788.

Thomas Howe, of Tavistock-street, Covent-garden, chemist and druggist: of a medicine for the cure of consumptions, asthmas, coughs, and other disorders, called (by the specifier) Howe's Pectoral Lozenges of Horehound. Cl. R., 28 Geo. 3, p. 6, No. 1. Oct. 6, 28 Geo. 3; Oct. 22, 1788.

William Hele, of Kingsbridge, Devon: of a drill machine for sowing grain, or any kind of seeds. Cl. R., 28 Geo, 3, p. 8, No. 15. Oct. 29, 29 Geo. 3; Nov. 15, 1788.

James Rumsey: of certain new methods of constructing boilers for distillation and other objects, and for steam engines for various purposes. Cl. R., 28 Geo. 3, p. 8, No. 11. Nov. 6, 29 Geo. 3; Dec. 6, 29 Geo. 3, 1788.

James Yates, of Bordsley, near Birmingham, brass-founder; of a new method of multiplying engravings or chasing on all kinds of metals, particularly applicable for the engravings or chasings on the ornaments of coaches and coach harness, and many other purposes where engravings or chasings are required. Cl. R., 28 Geo. 3, p. 15, No. 1. July 8, 28 Geo. 3; July 31, 1788.

William Dufour, of Cantshill, Bucks, gent.: of a machine called a fire-escape, for the preservation of life and property from the dreadful effects of fire. Cl. R., 28 Geo. 3, p. 22, No. 1. June 10, 28 Geo. 3; July 7, 1788.

John George Hohmann, of Rotherham, Statuary: of a new machine for making marbles for children from various sorts of marble and other substances. Cl. R., 28 Geo. 3, p. 28, No. 17. Jan. 15, 28 Geo. 3; Jan. 22, 1788.

David Yates, the younger, of Manchester, lining cutter and small ware manufacturer: of a machine for glazing or polishing cottons, linens, and mixtures, or cloth made either of cotton or linen, and cloth made of cotton and linen mixed together, and also all sorts of cloths or stuffs made of cotton and linen, or either of them, and any other material or materials of any width or breadth to two yards wide or broad, or of a greater breadth or width. Cl. R. 28 Geo. 3, p. 29, No. 1. April 22, 28 Geo. 3; May 14, 28 Geo. 3, 1788.

John Curr, Sheffield, gent.: of a new method of drawing or raising coals, lead, tin, or any other minerals out of mines, and of landing such minerals, and for other purposes mentioned in the letters patent. Cl. R., 28 Geo. 3, p. 33, No. 1. Aug. 12, last past; Sep. 6, 28 Geo. 3, 1788.

Edmund Cartwright, of Doncaster: of certain additional improvements on specifier's machine for weaving. Cl. R., 28 Geo. 3, p. 36, No. 5. Nov. 12, 29 Geo. 3; Nov. 14, 29 Geo. 3, 1788.

Robert Fourness and *James Ashworth*, of Halifax, gents.: of a steam or fire engine,

Digitized by Google

comprising three or any greater plurality of cylinders with the appendages thereto—capable of being commodiously applied to the purpose of conveying or impelling travelling carriages of every denomination, or giving circular or other motions without the assistance of a fly, and without being burthened with cold water for condensing the steam. Cl. R., 28 Geo. 3, p. 36, No. 1. Nov. 6, 29 Geo. 3; Dec. 6, 1788.

Mary Howson, of Tottenham High Cross, Middlesex, widow: of an invention (communicated to the specifier by her brother, Isaac Lascelles Winn, of the Island of Jamaica), of certain universal and perpetual principles of saving fuel in the heating, boiling, or evaporating all kinds of fluids, and certain new invented stills and boilers. Cl. R., 29 Geo. 3, p. 3, No. 1. June 9, 29 Geo. 3; July 8, 1789.

William White, of Garlick Hill, London, tallow-chandler: of a machine by which the noxious or foul air may be expelled in a short interval of time from any mine, ship, gaol, hospital chamber, or other close place, and fresh cool air introduced in its stead, however calm the atmosphere, or however warm or sultry the season or climate. Cl. R., 29 Geo. 3, p. 4, No. 15. May 12, last; June 11, 1789.

John Elin, of Pimlico, in the parish of Saint George, Hanover-square, gent.: of a machinery for cleaning the inside of chimneys. Cl. R., 29 Geo. 3, p. 4, No. 13. May 28, last past; June 25, 1789.

Henry Seymour Conway: of an entire new method of adapting or conveying the heat arising from the fire of coal employed in coke ovens (by a particular construction of such ovens and flues adjoining thereto or connected therewith) for the working of steam engines, baking of bread, meat, or other food, calcining or fusing of ores and metals, making of brass or steel, as also for the purpose of warming of rooms, staircases, or large buildings, heating water for baths, and which is applicable to many other useful purposes, and manufactories requiring the assistance of fire or heat, by which means the expense of the coal or other fuel, which hath hitherto been necessary for the above operations, is entirely or in the greatest part saved. Cl. R., 29 Geo. 3, p. 4, No. 2. June 23, 29 Geo. 3; July 20, 1789.

John Elin, of Pimlico, gent.: of an improvement to shoe-buckles. Cl. R., 29 Geo. 3, p. 4, No. 1. Aug. 29, last past; Sept. 23, 1789.

William Shorland, of Bristol, Esq.: of a regular rotary motion to go by a steam engine without any crank or cog-wheel, the machinery of which is to be fixed upon new invented gudgeons and brasses. Cl. R., 29 Geo. 3, p. 5, No. 1. July 30, 29 Geo. 3; Aug. 29, 1789.

James Norton, of Berners-street: of a profluvium box for the purpose of supplying carriage and all other kind of wheels with oil, by which means there is a constant flowing, or flux and reflux. Cl. R., 29 Geo. 3, p. 6, No. 10. Aug. 27, last past; Sept. 26, 1789.

Robert Cameron, of Lambeth, engineer: of new invented improvements on the methods of raising coals, ores, and water, and likewise certain new machinery for the working of coal mines. Cl. R., 29 Geo. 3, p. 6, No. 9. Sept. 5, 29 Geo. 3; Oct. 2, 29 Geo. 3, 1789.

Moses Hart, gent., of Southwark: of a new and particular method of manufacturing the sediment commonly called the bottoms, foots, or slush of whale oil, taken from the bone whale, or the sediments of seal oil, or of any other fish oil, and extracting, hardening, and purifying, and whitening the same, chiefly for the purpose of making candles. Cl. R., 29 Geo. 3, p. 7, No. 8. Nov. 6, 30 Geo. 3; Nov. 23, 30 Geo. 3, 1789.

Samuel Hands, of Wirksworth (Derby): of new invented spring shoe buckles, more useful and convenient than the buckles now in use. Cl. R., 29 Geo. 3, p. 11, No. 6. May 2, 29 Geo. 3; May 30, 1789.

John Bulkeley, of Chester, wine-merchant: of an ornamental steel case, or outward covering for the heels of shoes, boots, and slippers of men, women, and children, to be made of silver, gold, plated iron, or other metals, which may be wore either plain or decorated, and will give additional stability and security, as well to the shoes, boots, and slippers, as to the feet of the wearer, without the inconvenience of a ponderous incumbrance. Cl. R., 29 Geo. 3, p. 14, No. 1. July 30, 29 Geo. 3; Aug. 20, 1789.

Thomas Todd, of Owthorpe (Nottingham): of a machine on a new construction for the making of screws and nuts, and boxes for screws. Cl. R., 29 Geo. 3, p. 15, No. 15. July 7, 29 Geo. 3; July 20, 29 Geo. 3, 1789.

Samuel Boulton Harlow, of Ashbourne (Derby), watchmaker: of an invention of making watch-keys upon a new construction, by means of a spring, so as to preserve watches from injury when keys are turned the wrong way. Cl. R., 29 Geo. 3, p. 16, No. 7. Nov. 6, 30 Geo. 3; Dec. 1, 30 Geo. 3, 1789.

John Mannall, of Colchester, joiner and cabinet-maker: of a machine or wheel called a windlass-wheel, which being affixed or placed to an engine or crane for lifting

Digitized by Google

burthens or weights, will lift more ponderous and heavy burthens than any engine or crane, for the like purpose ever invented.

Cl. R., 29 Geo. 3, p. 20, No. 11. June 9, 29 Geo. 3; July 7, 1789.

(*To be continued.*)

LIST OF ENGLISH PATENTS GRANTED ON JULY 31, TO AUGUST 5, 1847.

Hector Sandeman, of Tulloch Bleachfield, Perth, bleacher, for certain improvements in the materials and processes employed in dressing, cleaning, scouring, and bleaching certain textile fabrics, and the materials of which such fabrics are composed. July 31; six months.

Theodore Fletcher, of Birmingham, brass founder, for an improved manufacture of speculums for various purposes. August 3; six months.

John Yule, of Sauchiehall-street, Glasgow, practical engineer, for certain improvements in chairs used on railways, and in the fixing of the same. August 3; six months.

Joseph Bourne, of Derby, Derbyshire, for improvements in the construction of kilns for burning stone ware and brown ware. August 4; six months.

Arthur Boyle, of Birmingham, umbrella-frame maker, for improvements in the manufacture of buttons. August 4; six months.

Thomas Birchall, of Ribbleton Hall, Lancaster, for improvements in folding newspapers and other papers. August 5; six months.

James Simister, of Birmingham, manufacturer, for improvements in the manufacture of stays and belts. August 5; six months.

William Broadbent, of Manchester, for improvements in the manufacture of paper. August 5; six months.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Aug. 2	1152	T. and C. Clark & Co....	Wolverhampton, iron founders,	Secret axle pulley.
3	1153	William Tilke	Holborn, manager of the Holborn Baths.....	National economic bath.
,,	1154	Edward Williams	Heneage-street, Spitalfields.....	Victoria septibus.
4	1155	Edward Nicholson	Bishop Auckland, Durham	Stock for a jumper drill.
,,	1156	Edward Nicholson	Bishop Auckland, Durham	Jumper drill.
,,	1157	James Clarke	Wellington-street, London	Hat suspender.
,,	1158	W. Grounsell	Louth, machine-maker	Improved winnowing machine.
,,	1159	James Basire, jun.	London, engraver	Improved blade protractor.

Advertisements.

TO MINE AND COLLIERY PROPRIETORS, SLATE QUARRY OWNERS, RAILWAY CONTRACTORS, IRONMONGERS, DEALERS IN GUNPOWDER, AND OTHERS.

MESSRS. JOHN HALL AND SON, THE PATENTEES AND SOLE MANUFACTURERS OF

SCHONBEIN'S PATENT GUN-COTTON,

Respectfully state, that they are now prepared to SUPPLY the PATENT GUN-COTTON (compressed for the convenience of carriage), in round and square paper cases, of 4 ozs. each, packed in boxes, containing 50 and 100 cases each, at the price of 3s. per lb., for ready money.

Also, in tubes or cartridges of... 1, 1⅛, 1¼, and 1⅜ inch diameter;
Containing ..... 2, 4, 6, and 8 ounces each, at the
Additional charge of..... 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 3 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

Office, 23, *Lombard-street, London.*

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs T. Burnell and Co., 1, Great Winchester-street, London.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are, that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

CONTENTS OF THIS NUMBER.

Description of Craddock's High-Pressure Expansion and Condensing Steam-Engine—(*with engravings*) 131
Cursory Observations on Microscopic Philosophizing, particularly in Reference to the Physiological Papers in the Transactions of the Royal Society 136
On Skew Piers and Iron Girders 132
On the Advantages of Dredge's Balance Bracket Girder. By William Dredge, Esq., C. E..... 133
Horæ Algebraicæ. By James Cockle, Esq., M.A., Barrister-at-law—(*continued*) 134
Lowthorp's Lock-Gate Improved. By John M'Gregor, Esq. 136
Effect of Premiums — Royal Agricultural Show 137
Sibley and Rutherford's Earthwork Tables—(Review) 138
Mr. Rowland's Improvements in Railway Buffers 139
Aerial Navigation. By Mr. Baddeley..... 140
Questions in Friction 140
Calendar of Specifications—(*continued*) 140
Weekly List of New English Patents 143
Weekly List of Articles of Utility Registered. 143
Advertisements 144

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1253.] SATURDAY, AUGUST 14. [Price 3d.

Edited by J. C. Robertson, 166 Fleet-street.

DOULL'S PATENT RAILWAY AND STEAM-BOAT SIGNALS.

Fig. 6.

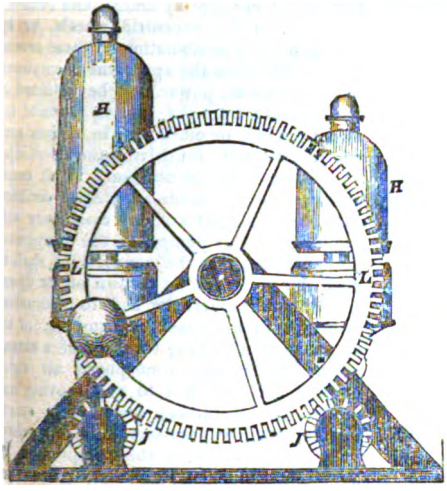


Fig. 5.

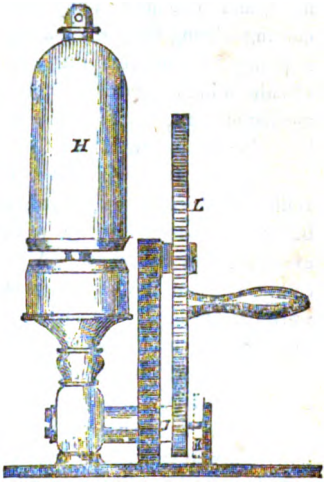
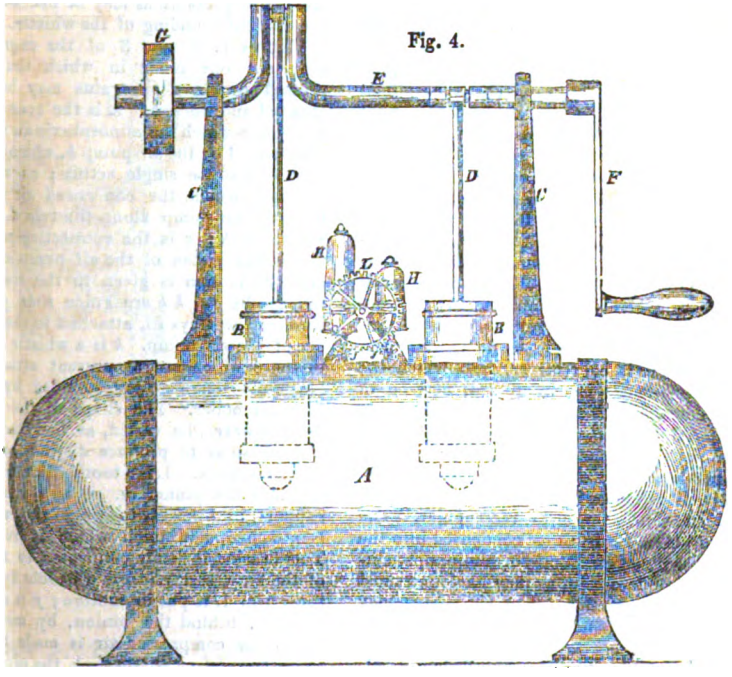


Fig. 4.



Digitized by Google

DOULL'S PATENT RAILWAY AND STEAMBOAT SIGNALS.

[Patent dated February 8, 1847. Patentee, Mr. Alex. Doull, C. E. Specification enrolled 8th August, 1847.]

MR. DOULL'S plans have the indisputable merit of being exceedingly easy of accomplishment: air—which is always at hand, and to be had in any quantity for nothing—being the principal agent, and a pump to compress the air, with a whistle to blow it through, being all the mechanical appliances requisite. They have this further merit, that if you once adopt them, they will never fail you. Boilers may become exhausted, or burst; but the atmosphere is a reservoir as everlasting as boundless. Air, besides, can beat steam at a blast any day. We were present lately at a series of experiments made with Mr. Doull's compressed air whistles, which left not a doubt on the minds of any present that, in point of intensity and variety of tones, they possess a vast superiority over the steam whistles now in ordinary use.

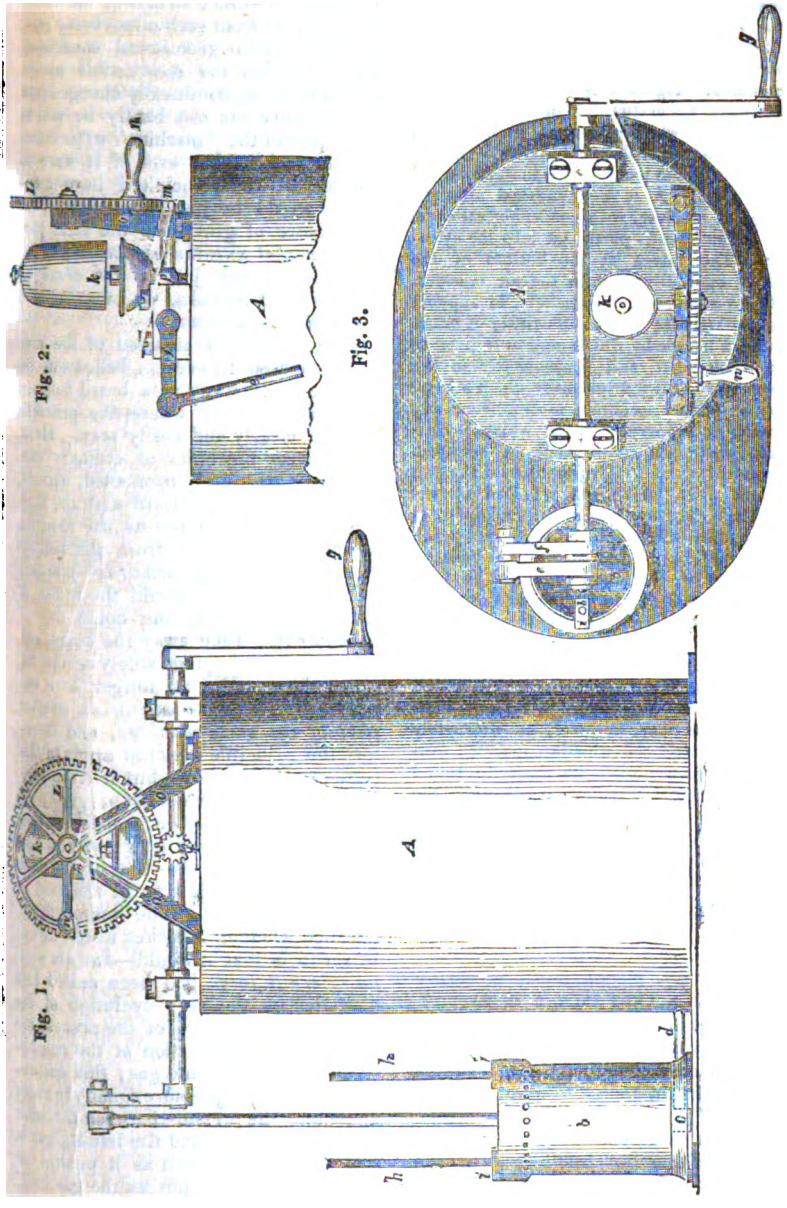
Mr. Doull describes his invention as consisting in the employment of a compressed atmospheric air apparatus for producing audible railway, steamboat, and other signals, in a similar, or a somewhat similar, manner to that in which sounds are now ordinarily produced by the steam whistle of locomotive engines, and also in a mode, or modes, of varying the sound and producing several distinct sounds by rapidly opening and shutting the communication between the reservoir of the compressed air and the whistle; and further in a mode or modes of combining two or more whistles of dissimilar sounds, so as to produce an extended scale of distinct signals.

The vessel, or receiver, into which the atmospheric air is compressed, may be of any convenient size, and composed of any material capable of being made air tight, and sustaining the necessary pressure; and it may also have any convenient shape given to it, as cylindrical, with flat or hemispherical ends, or square, or rectangular. The atmospheric air is to be condensed into the receiver by an air-pump, or air-pumps, single or double-acting, as may be found most suitable in practice. The air-pumps may be worked by hand, or by any other convenient means.

When the apparatus is applied to a railway train, and placed in charge of the guard of the train, or of a person appointed expressly to attend to it, motion may be communicated to the pumps from any moving part of the carriage by cranks and connecting-rods, or by eccentric wheels, or by bands, or by a combination of these several modes. Or when the apparatus is employed in a steamboat, power may be obtained in like manner from the moving parts of the steam-engine, or machinery in motion connected therewith, for driving the air-pumps. It will, however, be necessary in all cases, whatever be the mode adopted of connecting the moving parts of any machinery with the air-pump, or pumps, of the compressed air apparatus, that the connections shall be such as can be readily thrown off or disengaged, and recourse be had to manual labour, as in the case, for example, of the stoppage of a railway train, or of a steamboat. When the atmospheric air signal apparatus is attached to any moving machinery, as a railway train, or a steam-engine, it will be necessary to have a safety-valve connected with the compressed air vessel, and to keep it loaded to bear such maximum pressure as may be necessary for the efficient sounding of the whistle.

Figures 1, 2, and 3 of the engravings represent one mode in which the compressed air signal apparatus may be constructed and worked. A is the receiver, or vessel into which the atmospheric air is to be compressed by the air-pump *b*, which is here supposed to be single acting; *c* is a valve through which the condensed air passes from the air-pump along the tube *d* to the air vessel A; *e* is the connecting-rod between the piston of the air-pump and the crank *f*; motion is given to the crank by the handle *g*. *h h* are guide rods passing through the stays *i i*, attached to the cylinder of the air-pump. *k* is a whistle similar to those which are at present attached to locomotive engines and sounded by steam from the boiler. The shape of the whistle may, however, be varied, as hereinafter explained, so as to produce distinct and dissimilar sounds. L is a toothed wheel working into the pinion *m*. *o* is a triangular support, or bracket, to which the wheel L is attached, and upon which it revolves. This bracket is firmly connected to the top of the air-vessel A. *n* is a handle by which the wheel L is put in motion; *p* is a cock, or valve, behind the pinion, by means of which the compressed air is made to pass from the receiver A, through the pipe *r*, to

Digitized by Google



the whistle *k*. The pinion *m* is attached to rapidly a thrilling sound is produced, which
this cock, and when the wheel L is revolved may be so varied and combined with other

Digitized by Google

sounds as to form a gamut of considerable range, which may be still farther extended by a combination of two whistles of dissimilar sound connected by wheel-work or otherwise, as afterwards explained.

Figures 4, 5, and 6 represent an apparatus with two air-pumps and two whistles combined. Figure 4 is a front elevation of the entire apparatus. Figure 5 is a front view of the whistles, wheel, pinions, &c., on an enlarged scale; and fig. 6 is a side elevation of the parts shown in fig. 5 on the same scale. A is a cylindrical air-tight vessel, or receiver, with hemispherical ends. BB are air-pumps partly let into the cylinder. The valves at the bottom of the pumps open directly into the air receiver. C C are standards, or brackets, to support the crank-shaft; D D piston-rods; E crank shaft; F handle by which motion is given to the crank shaft, and consequently to the air-pumps. G is a drum, over which a band may be passed to obtain motion from any moving machinery. H H whistles connected with the compressed air receiver. L toothed wheel to give motion to the two pinions J J, which are attached to the whistles. These pinions are placed upon, or rather form, the handles of the cocks which admit the compressed air to the whistles from the receiver, and they are so constructed that they can be moved away from the toothed wheel L, as shown at K, fig. 6.

By the motion of the wheel L, when the two pinions are in connection therewith a thrilling sound is produced by both whistles. The pinions may, however, be alternately withdrawn, and the whistle connected with the withdrawn pinion be made to sound steadily, or not to sound at all while the whistle in connection with the toothed wheel is made to produce a thrilling sound. And in the same way a great many other peculiar combinations of sound may be produced.

REPLY TO MR. MACGREGOR'S QUESTION —COULD A ROCKET ASCEND IN VACUO?

Sir,—Although there would be nothing surprising in a far more "Homeric" personage than I can pretend to be being "found napping"—and Mr. MacGregor, if he thinks it worth his while, may find it no difficult task to prove that I am anything but infallible—in the present case he will find that "the principle" I have stated is perfectly correct. Mr. MacGregor has, I believe, misunderstood my meaning—perhaps from some obscurity in the wording. By a "machine" is meant any system of moving parts *invariably connected* with one another—the distances of the different portions from each other being subject to certain geometrical conditions. In the rocket the combustible matter which is being continually changed into an expansive gas can hardly be said to form part of the "machine" *after* it has left the rocket—but even if it were so considered, the principle I have mentioned would be just as applicable, for the centre of gravity of the solid part *of the rocket* AND *the expanded gas* remains stationary, just as the centre of gravity of two balls, or other masses repelling one another.

The example I adduced of the man who proposed to erect a bellows in his ship and puff away at a board fastened to its stern, is one where the principle is more clearly and easily seen. Here, as in most machines of ordinary use, the parts are rigidly connected, namely, the bellows and the board with the ship. Just as much therefore as the re-action of the current of air from the bellows would drive the ship *forwards*—precisely in the same degree would the impact of that current against the board drive it *backwards*. Take away the board, and let the current impinge solely against the atmosphere. We no longer have *one part of a machine acting on another part of the same machine*, and therefore the principle does not apply in this form of the question—but it is still perfectly true that the centre of gravity *of the ship and mass of air moved*, remains at rest. The centre of gravity of the ship moves forwards—that of the mass of air backwards, just as in the case of two repelling balls. The answer to the question whether a rocket would ascend in vacuo is that it would—*but not until an external force* had been called into operation by the very evolution of the gas itself. The steps of the process are the following: A portion of the composition is converted into gas; this gas expanding, exerts a pressure equally in every direction; the pressure between the solid part of the rocket and the issuing gas is *mutual;* just as much as it pushes the rocket forwards it pushes the gas itself backwards, and this latter action is precisely that *external* force to which I have alluded. If you like to consider

Digitized by Google

the expanded gas as still part of the "machine"—then the principle applies in its full force—the centre of gravity of this "machine" *does not move one inch*, though the rocket may move a hundred miles. But, taking the word in its more usual acceptation, then this *re-action against the issuing gas* is really an *external* force, and one without which there could be no motion of the rocket. It is easy, however, to see how extremely small must be the velocity of a rocket in vacuo where the re-action is the only one which can be called into play. If A denote the mass of the solid part of the rocket at any instant, B that of the portion converted into gas, V the velocity produced by the pressure of the gas in A, and v that produced at the same time in B, then $AV = Bv$, or $V = \frac{B}{A}v$, which is a very small fraction of v in the beginning, but becomes greater as the composition is more and more consumed.

Mr. MacGregor's mistake has evidently been, in considering the gas as *part of the machine*, whilst estimating the moving force, and then neglecting it whilst estimating the motion of the centre of gravity *of that machine*. If it be considered part of the "machine" in the one case, (which it must be, in order to bring the case under the head of the "Principle" alluded to,) it must be so in the other. If the pressure of the gas against the rocket be considered as an instance of "the action of one part of a machine on another part," then also must the centre of gravity *of that* "*machine*" be considered *not* as that of the *rocket alone*, but as that of the *rocket and gas* together. And *this* point does not move at all; though both that of the rocket and of the gas, considered separately, do.

As a question of a somewhat similar kind to the present subject, I take the opportunity of presenting the following to your readers: "If a rope be fastened to a man's waist, and passing over a fixed pulley in the ceiling, return to his hand, he need only exert a force of half his weight to support himself, *and any greater effort will cause him to rise.*" (*Whewell's First Principles of Mechanics*, p. 66.) Is the latter assertion correct, and if so show why it is so? if not, *what force* must be exerted to raise himself? And what will be the series of motions he must go through?

Yours, &c.,
A. H.

AERIAL NAVIGATION.

Sir,—The observations of "Argus" on my plan of aerial navigation, are conceived in so good a spirit, that, although his verdict is condemnatory, I must consider him more as a friend than an opponent. But, although I have only an ordinary pair of optics with which to compete with the hundred-eyed watchman of the gods, I yet think that I can discern some little instances of oversight in his observations.

About the appellation given to my machine, I will not dispute. "Argus" may have it "Archimedian Aerostat" if he pleases.

With regard to the effect of wind upon the navigation of a balloon, I think that the following fact should be more considered than it generally is, viz., that a balloon, unimpelled by machinery, is always at rest with respect to the air in which it floats, whether the air is in motion or not; and if a balloon is navigable at all, it is as navigable in a stratum of air in rapid motion as in one at rest. Its motion *in the air* and *over the earth* are two very different things; it is the latter motion only which shows the effect of the wind. So long as the velocity with which the balloon travels *in* the air is greater than the velocity with which the air travels *over* the earth, the balloon can be impelled towards any spot upon the earth, the rate of advance varying according to the direction of the spot, and the respective velocities of the air and the balloon. If the velocity of the air is greater than the intrinsic velocity of the balloon, the latter can only deviate laterally from the current. From these considerations, I do not see why the Archimedean screw should not be efficient for keeping the head of my machine pointed in the right direction. A navigable balloon can "feel" no wind but that which is caused by its own passage through the air. The wind is always "dead ahead," and the cylindrical form is perhaps less disadvantageous than some may suppose. It is evident that the "rude pressure of storms and tempests," to which navigable balloons have

Digitized by Google

been thought liable, exists only in the imagination.

In my answer to Mr. M'Gregor last month, "Argus" will find the dimensions proposed for my machine, and likewise some observations as to its stability.

"Argus" is afraid lest the carbonic acid gas evolved from a smoke-consuming furnace should "smother the aeronauts, from the way the mouth of the chimney is placed below the upper cylindrical bag." Having the mouth of the chimney low down is just the way to prevent such a catastrophe, carbonic acid gas being 1·52 times heavier than atmospheric air. But the necessity for such a contrivance seems likely to be obviated by Millholland's improved spark arrester, described in a late number of the *Mechanics' Magazine*. My object in proposing the consumption of the smoke, was to prevent the escape of sparks, which might fire the gas-bags.

When planning my parachute, I was well aware that Mr. Cocking had adopted the form of an inverted cone; but he was for placing the car low down, whereas I am for hanging it as high up as possible. I was led to the construction of my parachute, not from any consideration of what Mr. Cocking had done, but from the result of my own observations and experiments.

I did not state that "if *a* cylinder for gas be very large, the machine will become unmanageable," but that "if *the* cylinder, &c."—confining the observation to my own machine, and supposing the car and framework to remain fixed in size. I am by no means at issue with those high authorities who assert that large balloons are the best to navigate, seeing that the atmospheric resistance does not increase in so rapid a ratio as the buoyant power, a fact very encouraging to those who are endeavouring to solve the perplexing problem of aerial navigation.

Although the paddles of my machine are adapted to assist in lifting it, I yet fear that the most potent objection to it is, its want of buoyancy. This, however, as I have stated before, is a difficulty which I hope to conquer.

Trusting that your kindness will excuse my repeated intrusions on your columns, I am, Sir, yours, &c.,

JOSEPH PITTER.

Hastings, August 5, 1847.

HORÆ ALGEBRAICÆ. BY JAMES COCKLE, ESQ., M. A., BARRISTER-AT-LAW.

(Continued from page 136.)

III. NOMENCLATURE—SURD EQUATIONS—DIOPHANTINE ANALYSIS.

If we change the form of the equation (*a*)

$$(x^2+\tfrac{1}{2})^2=(y+\tfrac{1}{2})^2\ldots\ldots(1)$$

from the state in which it is above written, into

$$x^4+x^2+\tfrac{1}{4}=y^2+y+\tfrac{1}{4}\ldots\ldots(2)$$

the operation by which this change is effected is called EXPANSION; and, by analogy, the operation by which (2) is changed into (1) may be called CONTRACTION. The last term, were it generally employed would be found as useful as the former one: at least there are investigations in which its adoption would be of signal service. I may instance those in which we reduce any given expression to the form of a sum of algebraic powers—as is the case in some portions of my *Chapters on Analytical Geometry* (*b*).

Further—were the Nomenclature of Algebra *res integra* I confess that I should be inclined to make an alteration in the term "indeterminate" as applied to certain problems. A single equation between two undetermined quantities, subject to a limitation, condition, or restriction, as to the nature of those quantities (*e.g.* that they must be integers, squares, &c.) would not improperly be said to constitute a *limited*, *conditioned*, or *restricted* problem. Or, again, seeing that the second condition does not take the form of an *equation* (*c*) the problem consists of an equation and a limitation and so might perhaps be named a *mixed* or *compound* problem.

But, however this be, the use of single terms to express those operations which are of more frequent occurrence in Algebraical investigations often enables us to save a considerable quantity of explanation. On the other hand when, for the purpose of avoiding length and tediousness, a step is taken without

(*a*) This equation occurs in the Exercise *supra* p.p. 14—15.

(*b*) The portions alluded to will be found at p.p. 272, 293, 322, 323 of vol. xlvi. of this work.

(*c*) The distinction arising from this circumstance is adverted to *supra* p. 134.

Digitized by Google

indicating the process by which the advance is made, a simple term enables us to refer to the process without a tiresome repetition of lengthy phrases, and, at the same time, gives a greater clearness and logical precision to our researches. By way of example;—it is by no means unfrequent to change the form of an expression by adding to and subtracting from it the same quantity (*d*). So we often alter the form of an equation by adding equal quantities to, or subtracting equal quantities from each side of the equation,—as, for instance, in the ordinary solution of a quadratic. Now this operation might be termed SUPERPOSITION, and the words "by superposition" would explain the process. Of course this remark is only made with a view to the convenience of young readers; but then it is often the fate of this class of inquirers to be stopped and confused by the want of explanation of steps which, obvious enough to the practised mathematician, are yet full of difficulty to those whose experience and practice is not sufficiently great to enable them to reflect upon and perceive those steps with the requisite facility and promptitude.

In the note which introduces my (erroneously headed) Second *Chapter on Analytical Geometry* (*Mech. Mag.* vol. xlvi, p. 245) I have alluded to the distinction between "absolute zero" and $\frac{1}{\infty}$. The terms *absolute zero* and *zero* ought accordingly to be carefully distinguished in treating of Algebraic Nomenclature. In fact, without such distinction, we never could infer that a series

$$0x + 0x^2 + 0x^3 + \&c., \text{ in } inf.$$

may be zero *for all values of x*; and so a difficulty would be introduced into the subject of "Indeterminate Coefficients" (*e*).

I shall add a remark or two on surd equations. Let

$$F(x) = f_1(x) \times f_2(x) \ldots\ldots (3)$$

and let there be *two* (and only *two*) unequal values of x which will satisfy the equation

$$F(x) = 0$$

and suppose that *both the* values of x satisfy the equation

$$f_2(x) = 0$$

but that neither of them will satisfy the relation

$$f_1(x) = 0;$$

then, if there be any value of x which will make

$$f_1(x) = 0$$

that value must make

$$f_2(x) = \pm\infty$$

otherwise there would be more than two values of x capable of fulfilling (3). Now let

$$f_1(x) = 3x + \sqrt{30x - 71} - 5$$

$$f_2(x) = 3x - \sqrt{30x - 71} - 5$$

then there are only two values of x which will make $F(x)$ vanish (*f*); and those values also make $f_2(x)$ vanish (*g*), but neither of them will make $f_1(x)$ vanish; hence if

$$3x + \sqrt{30x - 71} - 5 = 0 \ldots\ldots (4)$$

then $3x - \sqrt{30x - 71} - 5 = \pm\infty \ldots (5)$

and subtracting the latter of these equations from the former, we obtain

$$2\sqrt{30x - 71} = \mp\infty \ldots\ldots\ldots (6)$$

and, substituting in (5) the value of x derived from (6) we obtain a result of the form

$$\infty = \text{a finite quantity}$$

which is absurd. Hence there is *no* value of x which will satisfy (4). Thus the doubt thrown out at p. 128 of Mr. Lund's edition of WOOD'S *Algebra* is removed, and our result is in conformity with the opinion of HORNER (*h*).

I shall resume the subject of "Congeneric Surd Equations," at another time, but I take this opportunity of suggesting the following

Exercise. Having given,

$$x = a - r$$
$$y = b - nr$$
$$z = nr - b$$
$$w = a + r$$

prove that the ratios a:b, and r:b, may be assigned so as to make

$$x^3 + y^3 + z^3 = w^3$$

(*d*) As in the processes used at the places cited in note (*b*).

(*e*) See WOOD'S Algebra (Lund's ed.) p. 194, *et seq.* where the zero's must be taken to be *absolute*.

(*f*) For $F(x)$ is, in this case, a quadratic function of x.

(*g*) WOOD (Lund) p. 128.

(*h*) *Vide supra*, p. 136, note (*p*). See also Professor J. R. Young's *Algebra*, 4th ed. (Lond. 1844) pp. 130—133.

Digitized by Google

and, combining results thence deduced, show that

$(282)^3=(81)^3+(85)^3+(138)^3+(171)^3+(239)^3$

With this Diophantine question I shall conclude the present paper.

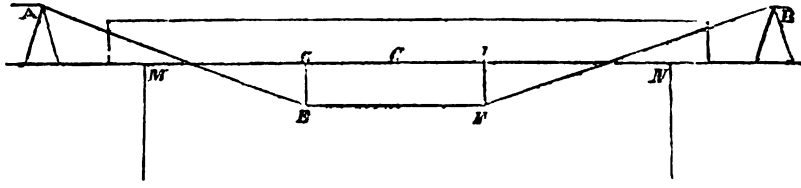
Corrections. Page 134, left hand column, equation (2), *for* + *read* −

Page 135, equation (5), *for* $\sqrt{5x}+10$ *read* $\sqrt{5x+10}$.

(*To be continued.*)

REMARKS ON MR. DREDGE'S PAPER ON IRON GIRDER BRIDGES (NO. 1251).

Sir,—As everything proceeding from Mr. Dredge on the subject of bridges is likely to command great attention from both practical and merely mathematical readers—I venture to request his attention to a few points in his investigation which, perhaps, he will be so good as to elucidate rather more fully, for the benefit of myself (and also, possibly, of some other of your readers). That to which I wish chiefly to call his attention, is the conclusion to which he has arrived (page 105, col. 2), viz., that the girder shown in the fig. 5 is "nine times stronger by such an arrangement of tensile bars than it would be without them."



From Mr. Dredge's description and fig., the truss-rods AEFB are perfectly unconnected with and independent of the girder or beam which is to be supported, except, I presume, by the props E*a* and F*b*. Assuming the point C, at which the fracture will take place, to be equally distant from E and F: and M*a* = *ab* = *b*N, if the whole length of the girder (QL) be uniformly loaded (the weight on each unit = μ), Mr. Dredge says, that "the moment of the superincumbent weight round C will equal $\frac{1}{9}$ L$^2\mu$." It appears to me that Mr. Dredge has not only omitted to take into account the re-action at the abutments M and N, but has made some incorrect assumptions in the following reasoning:—"Let μ be the load on each unit of L, then $\frac{2}{3}$ Lμ = the load between each of these equal spaces, or $\frac{1}{3}$ Lμ would be the resolved force on the props E and F. Hence $\frac{1}{3}$ Lμ. $\frac{1}{3}$ L = $\frac{1}{9}$ L$^2\mu$ = moment of superincumbent weight round the central point in the neutral axis, about which (in the event of rupture) the fractured ends would turn." Now the only way in which the problem can be treated, seems to me as follows:—The beam or girder is kept at rest by the following forces (all of which are supposed to remain vertical); the uniform load 2Lμ, which may be supposed collected at C, the two reactions at M and N, which we may assume each = P, and the two re-actions of the props at E and F, which we assume each = Q. This gives the equation

$$P+Q=L\mu.$$

Again, if M denote the moment of the internal elastic forces round the neutral axis through C, corresponding to Mr. Dredge's $\frac{T\,b_1\,n}{6d}\,(d^3-d_3^3)$.

$$M=L\left(P+\frac{Q}{3}-\frac{L}{2}\right).$$

How the second side of this equation can be got equal to $\frac{1}{9}$ L$^2\mu$, I do not see.

There is no necessary connexion between the pressure P and Q, except that their sum must equal the superincumbent load. Hence the problem must necessarily remain indeterminate.

Digitized by Google

But independently of this, Mr. Dredge, in the sentence quoted, appears to have reasoned thus:—"The load on EF is $\frac{2}{3}$ Lμ, and each prop bears half of this load; therefore the moment round C is the pressure at F multiplied by

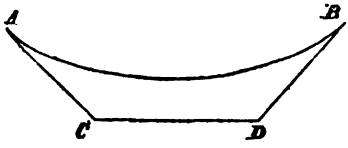
$$\frac{1}{2}\,\text{EF},\ \text{or}\ \frac{1}{3}\,\text{L}\mu \times \frac{1}{3}\,\text{L}."$$

Now, the load supported by each of the props at E and F is evidently not nearly half of that on EF; for this is neglecting altogether the portion on aM and bN, and the re-actions at the abutments.

Some parts of the investigation I cannot follow, from the omission of several of the letters in the diagrams (which I take this opportunity of commending to the attention of the wood-engraver, as a very frequent source of annoyance, the putting in correctly all the letters of a diagram being of more importance than any other part).

There can be no doubt whatever as to the much greater efficacy of independent and unconnected truss-rods, such as in the last figure, to those forming one rigid system with the girder itself; but I do not think their relative efficiency can be estimated in the way Mr. Dredge has attempted. The following questions I will take the liberty of putting, as some which may deserve consideration:

(1.) Supposing the girder AB to be bent, as in the figure,



would not the fracture take place far sooner in the rods AC and BD, rather than in either AB or CD?

It seems to me evident that these rods would be the first parts to give way, by snapping in two; and that it is to these that the principal care should be given, both where they are connected with the girder or perfectly distinct from it (except at C and D).

(2.) If this be true, whether Mr. Dredge's conclusion that "the assistance rendered by the tensile bars is in proportion to their depth," is correct? By the "depth," I suppose is meant the distance of CD from AB in the last figure. In Mr. Dredge's investigation (bottom of page 103) he has altogether omitted to consider the action of the bars AE and BF in fig. 3, and has made the whole depend on the action of the lowest rod EF. Now this supposes AE and BF perfectly rigid, whereas they would be the first to break, I believe.

As I may very possibly have misunderstood Mr. Dredge's meaning in some places, perhaps he will be kind enough to set me right.

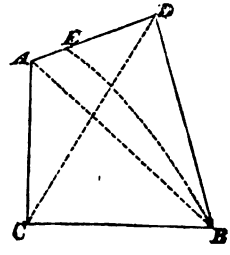
A. H.

YACHT SAILING.

Sir,—Having noticed the jib and foresail in a former number of your Magazine, I proceed to make some remarks upon the mainsail.

The management of this sail is one test of a sailor's experience. No two points of it are in precisely similar circumstances in relation to the wind, yet when once set, its position is regulated by a single rope. We may divide the action of the trapezoid mainsail into that of two jibs, the line A B being the foot of one A B D, and the leach of the other A B C, as shown in the figure.

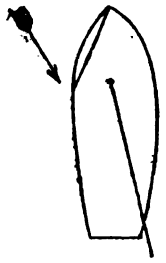
Fig. 1.



When sailing close hauled, it appears to me that the induced current of air between the foresail and the mast, and nearly parallel to the boom, increases the pressure on the mainsail by producing a partial vacuum to leeward of it. The existence of this draught from the foresail is often made manifest when a cutter is laying to with the foresheet hauled to weather.

Digitized by Google

Fig. 2.



The sails will then be in the position indicated in fig. 2, and a watchful eye will observe that the mainsail will then begin to shake near the tack, doubtless on account of the wind being brought more ahead by the deflection from the backed foresail. Again, the great loss of way consequent upon hauling up the maintack, may be attributed to the effective pressure being diminished by the free ingress to this vacuum then afforded to the wind; and I am convinced that it is nothing but a similar freedom from lee pressure, caused by the draught from the mainsail, which causes mizens to stand so well.

Those who assent to this idea will agree with me in approving of mainsails high in the hoist and short in the foot; and consequently in preferring (after a certain tonnage) the fore-and-aft schooner rig to that of a large cutter, whose gaff is so unmanageable as often to be three points to leeward when the mainboom is on the taffrail.

The two curves in the mainsail most objectionable from their convexity, are in planes perpendicular to that of the paper and passing through the points A B and C D, fig. 1. The weight of the boom and the tension of the sheet are the principal forces tending to lessen the first curve, while the second cannot be much reduced without a great strain upon the peak-halliards. The curvature along A B is lessened when the weight on the foot of the sail is increased; and hence we see one reason why a sail which would "*belly*" at full hoist may stand well when a couple of reefs are in. As for the second curve, it is made to disappear by using a sprit; and we may often see Thames barges, the flatness of whose mainsails would do credit to the rig of a yacht. The curved dotted line, fig. 1, is abaft the most efficient part of the area of a mainsail, the part forward nearly coinciding with the cut of a Bermudian mainsail of higher hoist. As to those "*appogiaturas*," gafftopsails, I shall only say, that I leave them alone; for, with the exception of the amount of sheet to be paid out to a mainsail, there is no more fertile subject for sailor's dispute than the cut of a gafftopsail.

I am, yours, &c.

JOHN MACGREGOR.

Battersea, August 7, 1847.

P. S. Corrections in the former communication on this subject. Read *vangs* for *vaugs*, *leach* for *leack*, and *aback* for *back*.

THE "QUESTIONS ON FRICTION" SOLVED.

Sir,—The questions asked by your correspondent who signs himself "A Constant Reader," are easily answered, though not exactly in the way he asks them. There is no relation existing between rolling and sliding friction; the former depending on the nature of the axles, the latter on that of the wheels and rails. It is, however, not difficult to calculate what would be the traction per ton in the case of sliding friction.

Let ϕ be the uniting angle of resistance between the wheels and the rails (or that angle at which an inclined plane must be elevated, so as just to cause the carriages to slide down); then if W be the weight of the carriages, W tan ϕ = tractive force necessary on a level, and which must be exerted in order to make the carriages just begin to slide.

$\therefore$ 2240. $\times$ tan ϕ = traction in pounds per ton.

In the case of iron sliding on iron $\phi = 23° 45'$ and 2240 tan $\phi = 197$ pounds.

Hence the traction is 197 pounds per ton.

If the rails were wet, the traction would be probably not much more than half this amount. So that in round numbers we may say that the friction of sliding is about 20 times that of rolling.

In answer to question 2nd., I may state, that the number of wheels would not affect the question; because, and this answers 3rd. question, the friction depends on the pressure alone, and scarcely, if at all, on the amount of rub-

Digitized by Google

bing surface and velocity of motion, the pressure being not too close to that which produces abrasion of the rubbing surfaces.

In answer to the 4th question: The momentum of the locomotive would be more speedily destroyed when the wheels were revolving the reverse way than when at rest; for beside that the momentum is working against friction, it is also working against the engine. The exact amount of resistance would only be determined from experiment, as it is evident. And we are not entitled to assume that it would be equivalent to the sum of the resistance due to the motion of the wheels, if there were no sliding, and to the sliding, if there were no motion of the wheels.

In conclusion, I may state, that some good experiments on the resistance opposed to trains, both with the breaks on and off, is still a desideratum.

I am, Sir, yours truly,

da.

ADVANTAGES OF ELECTRIC CLOCKS AT SEA.

Sir,—The great importance of a good time-keeper at *sea*, and the advantages the "*electric clock*" seems to possess over ordinary chronometers, has led me to think, that if it could be adapted to ship-use, a great good would result.

The electric clock, besides regularity of action, possesses the additional advantage of working for an indefinite period without interference or attention, and by the use of the *sea water* as the exciting liquid, I think the chief difficulty, that of obtaining a battery *of long continued action*, might be removed.

The fact, however, of a ship's not being *always* in *sea* water, may be found to be an obstacle. In that case, might not the "*water-battery*," the "mud-battery," or the "percolating galvanic trough," with some modifications, be successfully employed?

I have not leisure to satisfy myself of the practicability of these ideas by experiment, but submit them to the readers of the *Mechanics' Magazine*, hoping that they may induce some one to investigate the subject, and that results may be obtained practically useful.

I am, Sir, yours, &c.,

MECHANICUS.

Newcastle-upon-Tyne,
August 2, 1847.

THE ELECTRIC TELEGRAPH VOCABULARY AND THE PHONETIC SYSTEM.

Sir,—If you consider the following suggestions of improvement in the vocabulary used in the electric telegraph of any value, I shall be glad to see them inserted in your journal.

The improvement I am about to speak of is the substitution of the phonetic mode of spelling in the place of the old common method.

The phonetic system of writing possesses many advantages over the old hetrotypic method of spelling words: such as, an unvarying representation of the sounds of the human voice by the characters representing them — a correct method of spelling words according to their pronunciation—a saving of time in writing—and, in consequence, a less number of characters used to represent words.

I have now lying before me an extract out of Sacspear (Shakespeare) in the play Henry VIII., act 3, scene 2, containing 35 lines, written in both systems. The phonetic method is written with 180 letters less than the old system is written with.

If it is desirable to attain the highest state of perfection, I think the phonetic system should be adopted, especially as there is no further inconvenience attending the use of it than learning a new alphabet.

I will give a few samples of spelling in the old system for your inspection. The letters which are here *united* in the spelling of the words are such as are represented by *one* character in the new method, (viz.,) h-a-ve, f-a-m-es, ch-ee-se, bea-u-t-y, vic-t-ual-s, sh-ee-p, sh-ar-pe, mar-r-i-a-ge, &c., &c.

I think the foregoing is sufficient to illustrate my meaning; and I think it must be obvious that it would take less time to set Mr. Bain's machine to work with the phonetic system than it would with the hetrotypic.

I am, Sir, yours, &c.,

T. T. J.

Stoke-upon-Trent, August 11, 1847.

[Our correspondent has the merit of discovering one case in which the phonetic system might really be useful. As a general system it is one of the most absurd ever propounded.—ED. M. M.]

Digitized by Google

(Continued from p. 125.)

Fig. 18.

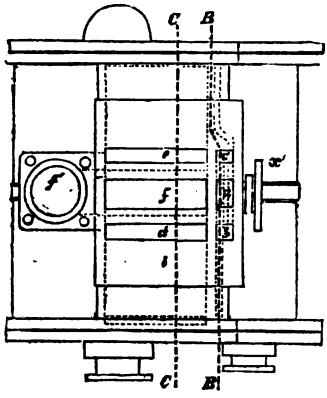


Fig. 16.

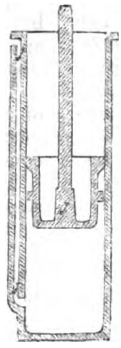


Fig. 19.

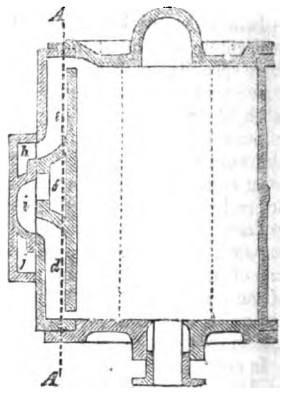
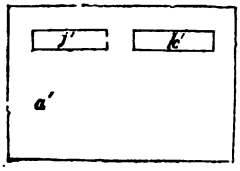


Fig. 15.

Fig. 14.



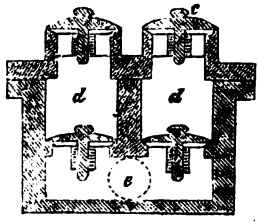


Fig. 22.

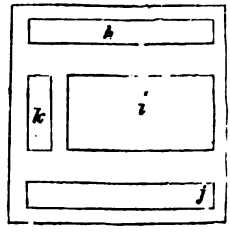


Fig. 17.

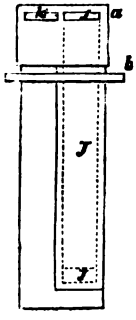


Fig. 21.

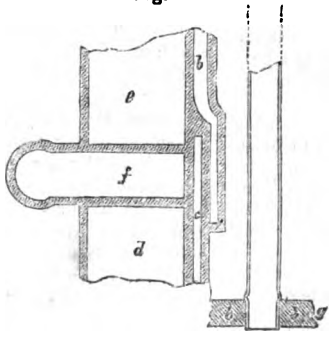
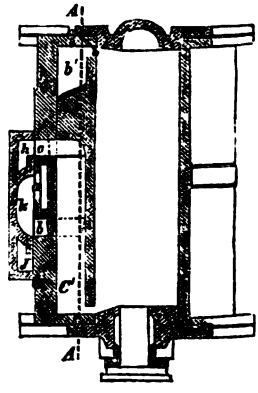


Fig. 20.



The Air Pump.

In figure 11* is the air-pump which is worked by means of the connecting-rod h^1, before mentioned as being carried from the cross-head *d* of the connecting rod of the small high-pressure cylinder.[†] The pump is double acting, and so constructed, that all the valves are at the top of the pump and kept constantly sealed by water, so that the external air can have no access into the interior of the pump. The details of this

* See last Number.

Digitized by Google

construction are shown in figures 14, 15, 16, 17. In figure 15 the front part is supposed to be removed. In figure 14 a^1 is a plate which screws on to the face *a* of figure 7, having two parts j^1 and k^1, which correspond with the apertures *j* and *k*; *b* is a flange cast on the pump barrel which supports a cistern *g*, which rises above the level of the valves and gland, and is kept constantly filled by water discharged from the pump, so that no air can find its way into the pump: *d*, *d* are the receiving valves; *e* is a pipe which leads from the condenser into the chamber underneath these valves, and is common to both, though the valves themselves are divided by a bridge *g*; *c c* are the delivery valves, the seats of which are screwed on the bridge *g* and flanges *i i*. The pump when in use is always filled with water at the bottom to a height a little way above the opening into the passage *j*, so that the piston *l* in its descent always dips into the water before it comes to the end of its stroke, and drives that water with the air before it up the passage *j*, whence they are discharged through the port j^1. And a like effect is produced at top by making the lid of the cylinder to descend a little way below the port k^1, and cutting out a passage in it to the port, whereby the lid meets the water on the top of the piston before it has quite completed its stroke, and drives the water and air before it through the port.

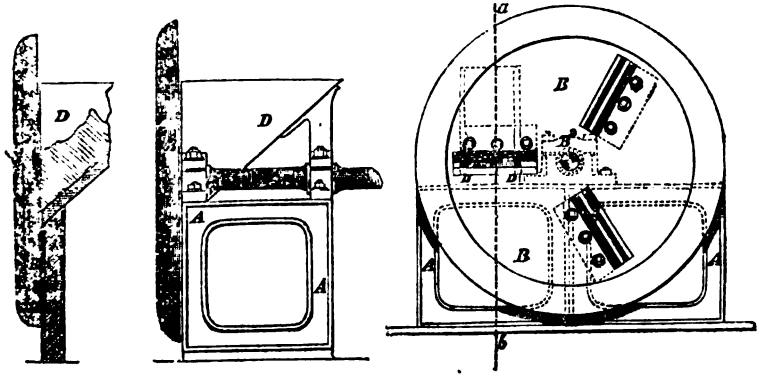
The Steam Valves.

The construction of these valves is represented in figures 18, 19, 20, 21, 22. Figure 18 is a plan of the steam ports; *a* is the port which communicates with the boiler through the induction pipe a^1; *b* and *c* are the ports which lead to the small or high-pressure cylinder, the former (*b*) communicating with it at the top, and the latter (*c*) at the bottom; *d* and *e* are the ports leading to the large or low-pressure cylinder, *d* leading to the bottom of the cylinder, and *e* to the top; *f* is the exhaust port, and f^1 the exhaust pipe. Figure 19 is a section on the line B of figure 1. Figure 20 is a section on the line C, and figure 21 is a section on the line A A of figure 3. Fgure 22 is a plan of the face of the valve. When the valve is in the position shown in figure 3, the steam passes from the bottom of the small cylinder through the passage *h* into the top of the large cylinder, while at the same time, the steam from the bottom of the large cylinder flows through *f* to the condenser. Figure 19 shows how the steam passes from the upper port *c* of the small cylinder (through the passage c^1 c^1) to the lower port *d* of the large cylinder. When the port *h* (figure 22) is over the ports *e* and *c*, the steam passes from the bottom of the small cylinder to the top of the large one, while the port *j* rests.

(*To be continued.*)

THE GUTTA PERCHA PATENTS.—NO. VIII.*

Fig. 2^a. Fig. 1. Fig. 2.



CHARLES HANCOCK, *of Grosvenor-place, Artist, for "Certain Improvements in the Preparation of Gutta Percha, and in the Application thereof, alone and in combination with other Materials, to Manufacturing Purposes, which Improvements are also Applicable to other Substances."* Patent dated Feb. 10, 1847; Specification enrolled August 10, 1847.

The improvements embraced by this patent have relation, *Firstly*—To the methods and machinery employed for preparing gutta percha for manufacturing purposes. In the specifications of former letters patent granted

* For specification of former patents, see *Mech. Mag.*, Nos. 1180, 1181, 1182, 1183—1185—1200—1233, 1233.

Digitized by Google

to me, touching the preparation and application of the said substance, I have directed that, for the purpose of cleansing crude gutta percha from the impurities which it contains, in the state in which it is ordinarily imported into this country, it should be first reduced into small pieces, by means of saws, knives, choppers, and other suitable instruments; and I have also therein observed that the cutting of lumps of gutta percha will be very much facilitated by first steeping them in hot water until they are softened. Now, I have since found that, by the employment of a machine of the description represented in figs. 1 and 2 of the annexed drawings, the crude gutta percha may be cut with the utmost facility into very thin slices, without any previous steeping in hot water; and that the washing, purifying, and softening of the material are best effected by passing it, after it has been so cut into slices, through the machinery represented in fig. 3 of the said drawings. The said machine and machinery are constructed and worked as follows:

Fig. 1 is a side elevation of the slicing machine; fig. 2, a front elevation of it; and fig. 2^a a sectional elevation A on the line $a\ b$ of fig. 2. A A represents the framework; B is a circular iron plate, of about five feet diameter, in which are three slots, into which are inserted three radial knives, in a similar manner to the irons of an ordinary plane or spoke-shave. B^2 is a shaft, to the end of which the plate B is attached, and by means of which it is made to revolve at any desired velocity, motion being communicated to the shaft from a steam engine, or any other convenient first mover, through the medium of gearing or drums. D is an inclined shoot, down which the lumps of crude gutta percha are dropped against the knives of the revolving plate B, by which they are cut into slices of a thickness corresponding to the degree of projection given to the knives. The slices are afterwards collected, and put into a vessel filled with hot water, where they are left to soak till they feel soft and pliable to the touch.

Instead of using a circular revolving cutter, such as has been just described, a vertical cutter, with rising and falling motion, may be used, and the other parts of the machine may be modified accordingly; but I prefer the former, as being more simple and equally efficient.

The knives are represented in the drawings as being straight; but where the gutta percha to be cut happens to be of a more than usually hard or intractable quality, I find it advantageous to substitute knives of a curved or reaping-hook form, on account of their more gradual mode of action.

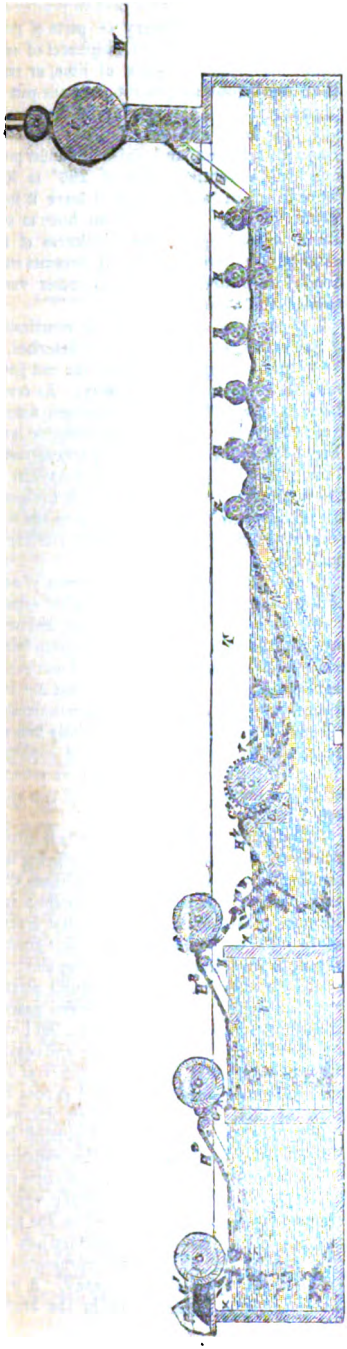
Fig. 3 is a longitudinal elevation in section of the machinery through which the gutta percha is passed, after having been steeped as aforesaid in the hot-water vessel till it has become soft and pliable to the touch. T is a large tank, which is divided into three compartments, t^1, t^2, t^3, of which t^1 and t^2 are filled with water to the height of the line $x\ y$, and t^3 with water to the height of the line $x\ z$. F^1, F^2, F^3 are three breakers or rollers, with serrated blades inserted in them in a direction parallel to their length, which are mounted transversely over the tank T, and revolve clear of the water. In front of each of these breakers there is a pair of fluted feeding-rollers, G^1, G^2, G^3. H^1 is a funnel-shaped shoot, through which the softened pieces of gutta percha, after being taken from the hot-water vessel, are passed to the feeding-rollers (G^1) of the first breaker F^1. H^2 is an inclined endless web, which revolves on two rollers $a\ a$, and dips at its lower end into the water, while at its upper end it comes opposite the space between the feeding-rollers of the breaker F^2. H^3 is a second inclined endless web, which bears the same relation to the third breaker F^3 as H^2 to F^2. K is a mincing cylinder, with radial blades (similar to that used in paper-mills for the conversion of rags into pulp), which is mounted transversely over the third compartment t^3 of the tank, but at a lower elevation than the breakers F^1, F^2, F^3, so that one half of it shall always be immersed in the water in that compartment. L L are edge-plates, so fixed that the blades of the cylinder K shall, in revolving, come into such close parallelism with them, as to produce, by their approximate conjunction, a scissor-like sort of action on any matters which may come in contact with them. The mincing cylinder K has, like the breakers F^1, F^2, F^3, an endless web (H^4), and a pair of feeding-rollers (G^4) attached to it. M is a rotary agitator, which is wholly immersed in the water of the compartment t^3. N is a revolving endless web, which stretches in an inclined direction athwart the whole depth of the water in t^3, and subdivides (as it were) the compartment t^3 into two divisions. R R, R R, are a series of pairs of rollers, mounted transversely over the after part of the compartment t^3, at such an elevation that the under rollers revolve under the water, and the upper just free of it. S S are a series of tables or benches, placed between the pairs of rollers, for the purpose of supporting the gutta percha in its passage from one to the other.

The action of this machinery, so far as it has been thus described, is as follows:

The feeding-rollers G^1, G^2, G^3, G^4, the

Digitized by Google

Fig. 3.



carrying rollers of the endless webs H^3, H^3, and H^4, and the rollers R R, are all made to revolve in a forward direction, or from left to right of the machine, as represented in the drawing, fig. 3, while the breakers F^1, F^2, F^3, the mincing-cylinder K, and agitator M are made to revolve in the opposite direction. (The mechanical contrivances by which those movements are effected are omitted from the figure, as being all of a common and well-understood description.) The breakers and mincing-cylinder should revolve at the rate of from 600 to 800 revolutions a minute, but the feeding-rollers and endless webs need not move faster than at about a sixth of that rate. The first series of rollers R R should revolve at the rate of from fifteen to twenty revolutions per minute, and the others may be made to exert a drawing or stretching effect on the materials passed between them, by causing one, two, or more of the last pairs in the series to revolve at a greater velocity than the preceding ones. As the crude gutta percha is presented by the feeding-rollers G^1 to the action of the first breaker F^1, it is broken up into shreds or fragments, and considerable quantities of earthy and other extraneous matters are beaten out of and disengaged from it, the whole falling in a mingled mass into the water beneath (that, viz., which is contained in the compartment f^1 of the tank,) where the different materials assort themselves according to their specific gravities. Such pieces as consist of pure gutta percha, or in which gutta percha predominates, float on the surface of the water, while most of the earthy and other extraneous matters sink to the bottom. The revolving endless web H^2 then draws towards it the floating gutta percha, and carries it upwards to the second set of feeding-rollers G^2, mounted over the second compartment f^2 of the tank, from which rollers it is delivered to the second breaker F^2, to undergo a repetition of the process which has been just described, in order to its being further disentangled and purified. From the surface of the water in the compartment f^2 the gutta percha is carried up the inclined endless web H^3 to the rollers G^3, which deliver it to the third breaker F^3 over the compartment f^3, by which it is a third time broken up, in order to any remaining impurities being separated from it. The inclined endless web H^4 next carries it forward to the rollers G^4, which present it to the revolving cylinder K, by the blades of which it is cut or minced into a multitude of very thin slivers, which, as they fall into the water in f^3, are thrown forward in the direction of the agitator M. As this agitator revolves in a direction opposite to that in which the floating mass of

Digitized by Google

gutta percha is moving, it forces the gutta percha down into the water, and to take a circuitous course through it towards the large endless web N, whereby it is washed free from any dirt which may have collected upon it in passing through the preceding operations. By the endless web N, the gutta percha is next moved onwards to the series of rollers R R, R R; and from the last pair of the series, the gutta percha is raised by an endless revolving web O to a pair of metal pressing and finishing rollers Y^1 Y^2, which are set by adjusting screws to a distance from one another equal to the thickness of the sheet or band into which it is now desired that the gutta percha should be compressed. After passing through between Y^1 Y^2, the sheet or band is carried back over the topmost of these rollers (Y^2), and then over the wooden drum U, to be wound on a taking-up roller V. As it is turning back over the roller Y^2, a sheet of cloth, or any other material suitable for joining with it, may be led in, as shown at W, and, by being pressed in conjunction with it between Y^2 and the drum U, it will be firmly united to it.

The water in all the compartments of the tank T should be used cold. When the crude gutta percha happens to have a fetid smell, as is not unfrequently the case, I mix with the water a solution of common soda, or of chloride of lime, as directed in the specification of former letters patent granted to me of date the 9th of November, 1846.

The whole of the improved machinery described under this head of my specification will be found also applicable to the cleansing, purifying, and otherwise preparing of bottle caoutchouc and of jintawan in its crude state.

Secondly, My invention consists in certain improvements or processes, previously patented by me for sulphuretting of gutta percha (since called metallo-thiönising), and in the application of these improvements to the sulphuretting of caoutchouc and jintawan. In the specification last hereinbefore cited, I have recommended that the sulphuretting of the gutta percha should be effected by means of sulphurets, such as orpiment or liver of sulphur in preference to sulphur itself; and I have there stated that though a portion of sulphur may be used in place of an equal portion of sulphuret, yet that I consider the use of sulphur to be altogether objectionable because of its offensive smell and tendency to efflorescence. I have since, however, ascertained, that if a very minute portion of sulphur be used along with a sulphuret, a better result is obtained from a combination of the two than from either substance alone. The proportions which I find best in practice are the following: To every 48 parts of gutta percha I add 6 parts of sulphuret of antimony, or hydrosulphate of lime, or some other analogous sulphuret, and one part of sulphur. When the mixture of these materials has been effected, I place the compound in a boiler, and raise it (under pressure) to a temperature of 260° to 300° Fahrenheit, in which state I leave it for a period varying from half an hour to two hours, according to the thickness of the materials, by which time it becomes completely sulphuretted, or in other words metallo-thiönised.

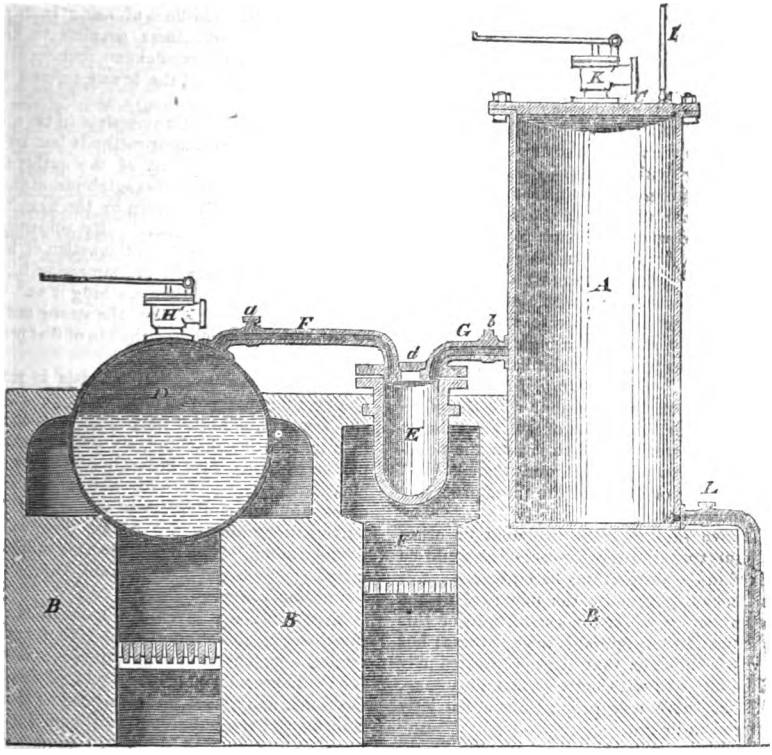
I apply precisely the same combination of materials, as has been just described, to the sulphuretting of caoutchouc and jintawan, and also in the same way. As caoutchouc is now ordinarily sulphurized, not less than one part in weight of sulphur is required for every six or eight parts of caoutchouc; but by substituting a sulphuret, to the extent hereinbefore directed, the quantity of sulphur may be reduced to less than a fiftieth part, and a much better article be produced.

I am well aware that the process of subjecting caoutchouc, combined with sulphur alone, to a high degree of heat, and various modifications thereof, have been before used and made known, first in America and subsequently in this country; but the improved process, which I have herein specified and lay claim to, differs essentially from all these, in the caoutchouc being combined with a sulphuret and only an exceedingly small proportion of sulphur, and then subjected to heat.

Thirdly, My invention consists in certain improved modes or means of effecting the combination of sulphur and sulphurets with gutta percha, and also with caoutchouc and jintawan. In the specification last hereinbefore cited of former letters patent granted to me, I directed that such combinations should be effected while the gutta percha, or caoutchouc, or jintawan, were passing through the masticating machine; but I now find that it may be more readily and equally well accomplished in one or other of the four following modes: First I expose the gutta percha, or caoutchouc, or jintawan, after it has been cleansed and purified and reduced to a sheet state, to the combined action of steam of a high temperature and the vapours of orpiment (or other volatile sulphuret) and sulphur (mixed in the proportions last hereinbefore specified), in an apparatus of the description represented in fig. 4 of the engravings annexed. A is a strong metallic chamber set in the brick-

Digitized by Google

Fig. 4.



work B B, into which the materials to be sulphuretted are placed. C is a steam tight cover or door, which is secured to the top of the chamber by screw bolts, so that it may be unscrewed and removed as occasion may require. D is a common high-pressure steam boiler. E is a strong metal pot into which the orpiment, or other sulphuret, and sulphur are placed. *d* a lid or cover through which the materials are introduced; and E′ a fire-place by which the pot is heated. F is a pipe leading from the boiler into the head of the pot E; and *a* a cock by which it is opened and closed. G^1 is a pipe leading from the top of the pot E to the chamber A, and *b* a cock by which it is opened and closed. H is a safety valve attached to the boiler, and K a safety valve attached to the chamber A. I is a thermometer to indicate the temperature. The mode of operating with the apparatus is as follows: The boiler furnace is first lighted, and when the safety valve indicates an approach to a temperature of 280° Fahr., the other furnace is lighted which is to volatilize the orpiment and sulphur. The cocks *a* and *b* are then opened, and the steam allowed to pass off through the pipes F and G, and head of the pot E, into the chamber A, containing the material, in order that they may be thoroughly heated before being sulphuretted. After a short time fumes from the orpiment and sulphur begin to ascend and mingle with the steam. In this state I leave matters for a period varying from half an hour to two hours, according to the thickness of the materials operated upon. I then close, by means of the cock *b*, the passage to the chamber A, draw or damp the fires, raise the safety valve K, and when the chamber A has been cleared of vapours, remove the sulphuretted materials. The safety valve H is kept all the time the sulphuretting process is going on, at a little higher pressure than the safety valve K, in order that there may be a current in the direction of the chamber A. L is a cock by which the condensed water, which accu-

Digitized by Google

mulates in the chamber A, is drawn off. Or, *secondly*, I take the gutta percha, caoutchouc, or jintawan, in a perfectly dry state, and rub them over with the sulphuret and sulphur, combined in the proportions aforesaid, and reduced to the state of a very fine powder; after which I place them in the chamber A of the apparatus last described, and subject them for a period, varying as aforesaid, to the action of steam, of about 280° temperature, without making any use of the volatilizing furnace: or instead of steaming them, I place them for the like space in water heated under pressure to about 280°. Or, *thirdly*, I take the materials, after they have been dry rubbed as last directed, and pass them through the whole of the first of the said processes; that is to say, I expose them both to steam of a high temperature and to the vapours of volatilized orpiment and sulphur. Or, *fourthly*, I make a paste of the sulphuret and sulphur with the addition of a small quantity of gutta percha or caoutchouc solution, brush it over the materials to be sulphuretted, and then subject them to one or other of the three processes previously described.

I have said that the orpiment or other sulphuret used in these processes should be mixed in the proportions hereinbefore specified, meaning thereby the new proportions recommended under the second head of this specification, as preferable to any others; but it will be obvious that these processes may all be followed with more or less advantage, whether these new proportions are strictly adhered to or not.

Fourthly. My invention consists in the following means or methods of improving the quality of gutta percha, both in a sulphuretted (metallo-thiönised) and unsulphuretted state, and in the application of the same to caoutchouc and jintawan in the like sulphuretted and unsulphuretted states. I either expose for a minute or two the materials to the action of binoxide of nitrogen gas, obtained by the usual method of dissolving a metal, such as zinc, copper, or mercury in nitric acid, or I immerse it in a boiling and concentrated solution of chloride of zinc, from a period varying from one to five minutes, according to the strength of the solution. And in either case, I afterwards wash the materials well in some alkaline solution, or in soft water. The materials may have the binoxide of nitrogen gas applied to them, either by putting them into the acid, while the metal is in the course of being dissolved, and the gas evolved, or by introducing them into a chamber in which the gas has been collected for the purpose. Gutta percha, which has been thus treated, and whether sulphuretted or unsulphuretted, becomes exceedingly smooth to the touch, and of a lustre approaching to metallic; so also does common unsulphuretted caoutchouc, with the addition of being entirely freed from that stickiness peculiar to it; while sulphuretted caoutchouc acquires under such treatment all the downy softness of velvet.

Fifthly. My invention consists in the application of the means or methods last specified to the improvement of the quality of the ordinary sulphurized caoutchouc, or that which is commonly known by the name of "vulcanized caoutchouc." By subjecting it in manner aforesaid, to the action of binoxide of nitrogen gas, or immersing it in chloride of zinc, and then washing it well, it loses entirely, or nearly so, the strong smell of sulphur, which makes the use of it at present so objectionable.

Sixthly. My invention consists in producing a new compound of gutta percha suitable for several useful purposes, by mixing, in a masticating machine, six parts of gutta percha with one of the chloride of zinc before mentioned; and in forming new compounds of caoutchouc and jintawan by a like proportional combination. All of these compounds admit of being afterwards sulphuretted (metallo-thiönised) or sulphurised in the ordinary way.

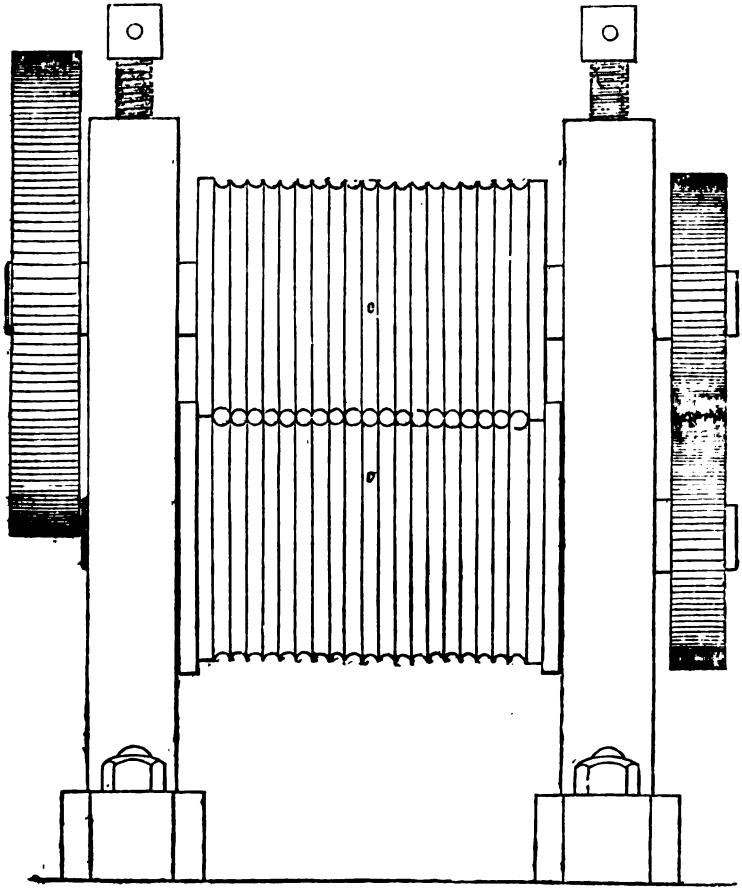
Seventhly, my invention consists of an improved combination of materials for producing a porous or spongy gutta percha, fit for stuffing or forming the beds of chairs, cushions, mattresses, saddles, horse-collars, railway carriage-buffers, and other like articles, similar to that described in my last hereinbefore cited specification; and the application of the said improved combination of materials to the rendering of caoutchouc and jintawan similarly porous or spongy. I take 48 parts of gutta percha, or caoutchouc, or jintawan (moistened, when a very soft and light product is desired, with oil of turpentine, or naphtha, or bisulphuret of carbon, or other proper solvent), six parts of hydrosulphuret of lime, or sulphuret of antimony, or any other analogous sulphuret; ten parts of carbonate of ammonia, or carbonate of lime, or other substance which is either volatile or capable of yielding a volatile product, and one part of sulphur. I mix the whole of these materials in a masticator together, and then subject them to a high degree of heat, observing the same conditions in respect thereof as are set forth in the specification last hereinbefore cited, except only that the heat may be pushed with advantage several degrees higher, say to from 260° to 300°.

Eighthly. My invention consists in the application of the various means and me-

Digitized by Google

thods of improving the quality of gutta percha, described under the third and fourth heads of this specification, to the improvement of the quality of articles manufactured of ordinary gutta percha, after they have been so manufactured; and in the application also of the same means and methods to the improvement of manufactured articles of caoutchouc or jintawan, or of any compound or article of which gutta percha, caoutchouc, or jintawan may form a part. Among the gutta percha and caoutchouc articles which may be most improved in quality and appearance by these processes (whether applied to the material before it is made up or afterwards), are—those waterproof fabrics known in commerce by the name of "double and single textures," boots, shoes, galoshes, gaiters, braces, belts, bands, bandages, capes, cushions, life-preservers, (flexible) bottles, bags, tubes, hose, flasks, cases, sheaths, holsters, cartouch-boxes, knapsacks, caps, helmets, hats, cups, bowls and other vessels of capacity, hammercloths, gig-aprons, printers' blanketting, covers for rollers employed in pressing and finishing soft goods, cotton-spinning rollers, backs of cards for carding wool, backs of brushes, washers, flute-key stops, piano-hammers, bottle-stoppers, capsules, cord, thread, string, rings, paper-holders, springs, trusses, trouser and other straps, &c., &c.

Fig. 5.



Ninthly, 'My invention consists in producing by the combination of gutta percha, caoutchouc, and jintawan, or with other materials, a fabric of a permanent lustre

Digitized by Google

resembling that of japanned goods; and by giving the like lustre to articles made of any of these materials in a sulphuretted or metallo-thiönised state. I take the gutta percha, caoutchouc, or jintawan, after it has been sulphuretted, or metallo-thiönised, any of the processes before described, or by by any other known process, and thereby enabled to bear a high degree of heat—and either before or after it has been made up into an article of use—and brush it over with a solution of resin in boiling oil. I then place the article from two to five hours in a chamber heated to from 75° to 100° Fahrenheit, and afterwards polish it by the means and in the manner usually adopted by japanners. In some instances I mix colouring matters with the japanning materials, which I apply by blocks, cylinders, or rollers, in the usual way of floor-cloth printing.

Tenthly, and lastly, my invention consists of an improved machine, or apparatus, for cutting gutta percha into strips or ribands, and manufacturing it into thread or cord of any required shape. A front elevation of as much of the machine as is necessary to an understanding of its construction is given in fig. 5. C C are two grooved rollers made of steel or iron, which are mounted in a suitable framework. The grooves of each roller are semicircular, so that when the grooves of one roller are brought opposite to those of the other, they form together a series of circular holes. The projecting divisions between the grooves are made with knife-edges, so as to divide readily any sheet or mass of gutta percha which may be presented to them. The under roller is flanged at both ends, and the two ends of the upper roller are made to fit inside of these flanges in order to keep the cutting edges from shifting or being damaged. To cut thin sheets of gutta percha with this machine into strips or ribands, the material is passed through it cold, and the cutting edges only brought into operation. To make round thread or cord by means of it: either a sheet of gutta percha, of a thickness equal to the diameter of the holes of the machine, is passed through it, at a temperature of about 200° Fahrenheit (by supplying the material from a feeding-chamber heated to that degree by steam or otherwise), and the threads or cords after coming from the machine are received into a tank of cold water, from which they are led away to, and wound on, reels or drums conveniently placed for the purpose: or the gutta percha is employed in a plastic state, and passed towards the machine under a gauge, after the manner commonly followed in the caoutchouc and gutta percha manufactures.

Should it be desired to produce cord of a half round, or semicircular form, I take away the under roller, and substitute for it a plain roller. Or should cord of a form neither circular nor semicircular, but square, triangular, hexagonal, or of any other angular form, be required, I dismount both cylinders, and substitute two others grooved in such manner as to produce the desired figure.

And having now described the nature of my said invention, and in what manner the same is to be performed, I declare that the improvements which I claim, as comprised in the said invention, are as follows:

First, I claim the preparation of gutta percha for manufacturing purposes, by means of the machines or machinery represented in figs. 1, 2, 2ª, and 3 of the drawings annexed and hereinbefore described; that is to say, in so far as regards the peculiar adaptation and order of sequence of the parts of the said machinery, and general arrangement and combination thereof; but without laying claim to any of the parts of which the said machine or machinery consists, singly and separately considered.

Second, I claim the new combination of materials for sulphuretting or metallo-thiönising gutta percha, specified under the second head of this specification.

Third, I claim the several new methods of combining sulphur and sulphurets with gutta percha, described under the third head of this specification; and the apparatus represented in fig. 4 of the annexed drawings, in so far as it forms an adjunct to such methods.

Fourth, I claim the employment of binoxide of nitrogen and chloride of zinc, for the purpose of improving the quality of gutta percha, as before described.

Fifth, I claim the application of binoxide of nitrogen and chloride of zinc to the improvement of the ordinary sulphurized or vulcanized caoutchouc, as before described.

Sixth, I claim the new compounds of gutta percha, caoutchouc, and jintawan, specified under the sixth head of this specification.

Seventh, I claim the improved combination of materials for producing porous or spongy gutta percha, caoutchouc, and jintawan, described under the seventh head of this specification.

Eighth, I claim the application of the various processes described under the third and fourth heads of this specification, to the improvement of articles of gutta percha in a manufactured state, after they have been so manufactured, as before exemplified.

Ninth, I claim the mode of giving to sulphuretted or metallo-thiönised gutta per-

Digitized by Google

ches a japan-like lustre, as before described, whether applied before or after the making up of the same into articles of use.

Tenth, I claim the improved machine or apparatus for cutting gutta percha into strips or ribbands, and manufacturing it into thread or cord, before described.

And, *Eleventh*, I claim the application of the whole of the said improvements to caoutchouc and jintawan (in so far as such application has not been already claimed), to the extent before pointed out and explained.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 143.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

Moses Boorn, of Barford, (Wilts): of a new machine or engine for sowing all sorts of corn and grain in drills or rows, which will sow or plant any number of drills or rows from three to thirteen or upwards (according to the width of the machine), at one time, at any distance from each other, at any depth, and with any quantity of corn or grain in each drill or row required or thought necessary; and which machine or engine is adapted to use in all kinds of land, and to every possible different mode of cultivation or tillage, and by the use of which much labour and expense in sowing, and much seed corn will be saved, as a man with a machine drawn by two horses only will sow eight acres of land or upwards in one day, and with much less seed corn than by the common way of broadcast sowing. Cl. R., Geo. 3, p. 22, No. 3. Aug. 27, 29 Geo. 3; September 26, 1789.

Walter Taylor, of Southampton, blockmaker, and *William Collins*, of the parish of St. Mary, Lambeth, engine maker: of a great improvement in the construction of pumps, the chambers, pistons, and boxes thereunto belonging, so as to prevent their being choked with gravel, sand, and filth, on ship board, and for raising water with less power than those now in use. Cl. R., 29 Geo. 3, p. 22, No. 1, September 19, 29 Geo. 3; October 15, 1789.

James Templeman, of Salisbury, gunmaker: of an invention for making locks to discharge double-barrel guns and pistols by means of one trigger only, without the possibility of discharging both barrels at the same instant, but whereby the one may be discharged in immediate succession to or at any distant period from the other. Cl. R., 29 Geo. 3, p. 23, No. 1. November 6, 1789; December 1, 1789.

Stephen Hooper, of Margate, gent. of certain new-constructed machinery for regulating the power and motion of wind and other mills, as also the process of grinding and dressing therein, and for regulating all other machinery where the first motion is unequal. Cl. R., 29 Geo. 3, p. 24, No. 13. October 29, 30 Geo. 3; November 23, 1789.

Charles Smith, of Northampton, lace manufacturer: of an invention whereof the specifier has become possessed, and which is new in this kingdom, being a machine for the making of thread used in the manufacturing of bone lace, commonly called Mechlin Long Dozen, and Bell. Cl. R., 29 Geo. 3, p. 30, No. 13. May 9, 29 Geo. 3; May 21, 1789.

Edmund Cartwright, of Doncaster, clerk: of new invented machinery for the breaking, combing, heckling, preparing, spinning, sizing, dressing, and winding upon the pin, wool, tow, hemp, flax, and cotton. Cl. R., 29 Geo. 3, p. 32, No. 4. August 3, 29 Geo. 3; August 22, 1789.

John Wilkinson, of Broseley, ironmaster: of an improvement in the method of making cannon, or any other piece of ordnance roade of metal, together with its shot, shell, marrow, so contrived as to give a more certain direction to the mark intended, than any other that has been hitherto in use. Cl. R., 29 Geo. 3, p. 32, No. 3. July 30, 29 Geo. 3; August 14, 1789.

Thomas Rowntree, of Surrey-street, of Christ Church (Surrey), engine maker: of "a new improvement in the construction of water closets, and which may be applicable to other useful purposes." Being a portable water closet, to which may be applied the specifier's "Circular Sliding Valve," which has the properties of both a valve and cock. Cl. R., 30 Geo. 3, p. 1, No. 18. Dec. 8, 30 Geo. 3; January 2, 1790.

John Baynes, of the Precinct of Bridewell, London, wharfinger: of an improvement in the construction of soup ladles, tureens, gravy spoons, ladles, and skimmers, for the more easily separating of mixed fluids of different densities, where one floats upon the surface of another, such as fat on the surface of soup, cream upon the surface of milk, and other chemical and philosophical operations. Cl. R., 30 Geo. 3, p. 1, No. 17. Dec. 8, 30 Geo. 3; Jan., 5, 1790.

George Godfry, of Tufton-street, Westminster, organ builder: of a new invented tamborine, tabor, or drum and pipe, which may be annexed or joined in or to barrel-

Digitized by Google

organs and musical instruments, and of a method of building such barrel organs and musical instruments for the same, so as to beat and play the said tamborine, tabor, or drum and pipe therewith at pleasure. Cl. R., 30 Geo. 3, p. 1, No. 16. Dec. 8, 30 Geo. 3; January 7, 30 Geo. 3, 1790.

John Maxwell, of Brook-street, Holborn, buckle maker: of an invention of spring fastenings for shoe buckles. Cl. R., 30 Geo. 3, p. 1, No. 15. Dec. 8 last; Jan. 8, 30 Geo. 3, 1790.

George Coates, of Shoe-lane, London, carpenter: of "an invention of a machine for washing, scouring, or cleansing linen, cotton, and woollen cloths, or any other woven or knit fabric," which may be worked by a pendulum or other lever, or by a revolving motion. Cl. R., 30 Geo. 3, p. 1, No. 14. December 12, 30 Geo. 3; Jan. 11, 1790.

Joseph Bramah, of Piccadilly, engine maker, and *Thomas Dickinson*, of Bedworth-close (Warwick), gent.: of "a new improved engine or machine on a rotative principle," which has undergone a very copious description in a former patent, and is a machine calculated for a great variety of applications which may from time to time render sundry non-essential variations in its construction necessary. Cl. R., 30 Geo. 3, p. 1, No. 4. Jan. 15, 30 Geo. 3; Feb. 13, 1790.

John Dring, of Walworth, Newington (Surrey), brass worker and hydrometer maker: of a certain improvement on all cocks, which from the nature of such improvement are termed ball cocks, which said improvement consists of inclosing in the body of the said cock, that part of the key that is pierced through for the purpose of retaining and letting out the liquid contained in the vessels, which part of the key so inclosed is in the form of a ball or cone, or oblique, or scaline cylinder, and by inclosing an internal screw in water ball cocks; the whole of which improvement is designed to preserve the said cocks in a perfect state, not liable to those imperfections that all mettle cocks hitherto made have been subject unto. Cl. R., 30 Geo. 3, p. 1, No. 3. Jan. 20, 30 Geo. 3; February 9, 1790.

Thomas Ribright, of the Poultry, London, mathematical instrument maker: of an instrument to serve as an artificial horizon, by means of which the sun's altitude may be taken at sea, with a Hadley quadrant, and the latitude found when the real horizon is obscured or invisible. Cl. R., 30 Geo. 3, p. 1, No. 1. March 2, 30 Geo. 3; March 22, 30 Geo. 3, 1790.

Samuel Hooper, of St. Giles-in-the-Fields, bookseller and stationer: of a new invention for manufacturing from leather, leather cuttings, shavings, or parings of every kind of leather whatsoever, and whit leather, a leather for covering the fronts, backs, sides, and tops of coaches, &c., and trunks, and for making band, hat and other boxes, waiters, tea trays, &c., mouldings, cornices, &c. for rooms, and for binding of books; and, with some variation in the process, paper for copper plate printing, brown and white-brown paper, and for drawing. Cl. R., 30 Geo. 3, p. 2, No. 5. Jan. 20, 30 Geo. 3; Feb. 19, 1790.

James Tate, of St. Mary-le-bone, ironmonger: of an invention of a machine upon an improved principle, for the purpose of raising of ballast, discharging the cargoes of ships, and otherwise assisting in the performance of many useful and laborious works. Cl. R., 30 Geo. 3, p. 3, No. 3. March 13, 30 Geo. 3; April 12, 1790.

William Freemantle, of Aldersgate-street, London, watchmaker: of an improvement on the vertical weight and spring roasting jacks, which render the same less complicated. Cl. R., 30 Geo. 3, p. 3, No. 2. March 24, 30 Geo. 3; April 13, 1790.

Charles Earl Stanhope: of "a method of constructing ships and vessels, and of moving and conducting them with great velocity without the help of sails, and also moving and conducting them against wind, waves, current, or tide, or against the power of them all united;" involving a peculiar build of ship, having head and stern of the same shape, so as to navigate narrow rivers without turning, and sail with and against wind, called by the Specifier, An Ambi-Navigator; also a peculiar kind of rudder, called by the Specifier, An Equipollant Rudder, and machinery for propelling the vessel to be set in motion by men, horses, or steam. Cl. R., 30 Geo. 3, p. 4, No. 12. March 13, 30 Geo. 3; May 7, 1790.

George Holland, of St. Andrew, Holborn above the Bars, frame work knitter: of a new sort of manufacture of stockings, gloves, mits, socks, caps, coats, waistcoats, breeches, and other articles of clothing and linings of clothing, and other things where warmth is required, and also of blankets, carpets, and tapestry, and in imitation and to answer to the purposes of furs and skins of various kinds, a thing never before put in practice. Cl. R., 30 Geo. 3; p. 4, No. 10. March 20, 30 Geo. 3: April 19, 1790.

Henry Downer, of Fleet-street, London, ironmonger: of an invention of a spring for the purpose of shutting a door. Cl. R., 30 Geo. 3, p. 4, No. 8. April 13, 30 Geo. 3; May 12, 1790.

(*To be continued.*)

Digitized by Google

LIST OF ENGLISH PATENTS GRANTED FROM AUGUST 5 TO AUGUST 13, 1847.

Benjamin Bailey, of Leicester, machine maker, for improvements in the manufacture of knitted fabrics. August 6; six months.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Aug. 4	1158	W. Grounsell	Louth, machine maker	Improved winnowing machine.
„	1159	Jas. Basire, Jun.	Red Lion-square, London, engraver	Improved blade protractor.
6	1160	John Parsons	Nottingham, brace-maker	The Albert brace,
7	1161	Simister and Holland	Cheapside, London	Ladies' petticoat, or dress dilator.
„	1162	Simister and Holland	Cheapside, London	The dilator.
„	1163	The Crane Foundry Company	Wolverhampton	Sash-pulley, box, or frame.
11	1164	Charles John Rowlands	Birkenhead, shirt-collar maker	Band of shirt-collars.

Advertisements.

TO MINE AND COLLIERY PROPRIETORS, SLATE QUARRY OWNERS, RAILWAY CONTRACTORS, IRONMONGERS, DEALERS IN GUNPOWDER, AND OTHERS.

MESSRS. JOHN HALL AND SON, THE PATENTEES AND SOLE MANUFACTURERS OF

SCHONBEIN'S PATENT GUN-COTTON,

Respectfully state, that they are now prepared to SUPPLY the PATENT GUN-COTTON (compressed for the convenience of carriage), in round and square paper cases, of 4 ozs. each, packed in boxes, containing 50 and 100 cases each, at the price of 3s. per lb., for ready money.

Also, in tubes or cartridges of... 1, 1¼, 1½, and 1¾ inch diameter;
Containing ..... 2, 4, 6, and 8 ounces each, at the
Additional charge of..... 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 3 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

Office, 23, *Lombard-street, London.*

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs T. Burnell and Co., 1, Great Winchester-street, London.

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings, and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Patent Bells.

MESSRS. MEARS beg to call the attention of the Trade and the Public generally to these articles, which they are now prepared to supply in any quantity and variety. The composition is of a new metal, called the Union Metal, and the bells are of very beautiful tone, and cheaper than those made of the ordinary bell metal. Orders received at the Bell Foundry, Whitechapel, for house, cattle, and other bells.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are, that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

CONTENTS OF THIS NUMBER.

Description of Doull's Patent Railway and Steam-Boat Signals—(*with engravings*) 145

Reply to Mr. MacGregor's Question, "Could a Rocket Ascend in Vacuo?" 148

Aerial Navigation — Reply by Mr. Pitter to Argus 149

Horæ Algebraicæ. By James Cockle, Esq., M. A., Barrister-at-Law. III. Nomenclature—Surd Equations—Diophantine Analysis 150

Remarks on Mr. Dredge's Paper on Iron Girder Bridges. By A. H. 153

On Yacht Sailing. By John MacGregor, Esq. 154

The "Questions on Friction" Solved 154

Advantages of Electric Clocks at Sea 155

The Electric Telegraph Vocabulary and the Phonetic System 155

Mr. Craddock's High-Pressure, Expansion, and Condensing Steam-Engine—(*continued*) —(*with engravings*) 156

The Gutta Percha Patents.—No. VIII. Mr. Charles Hancock's, for Improvements, &c.—(*with engravings*) 157

Calendar of Specifications—(*continued*) 165

Weekly List of New English Patents 167

Weekly List of Articles of Utility Registered... 167

Advertisements 167

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,

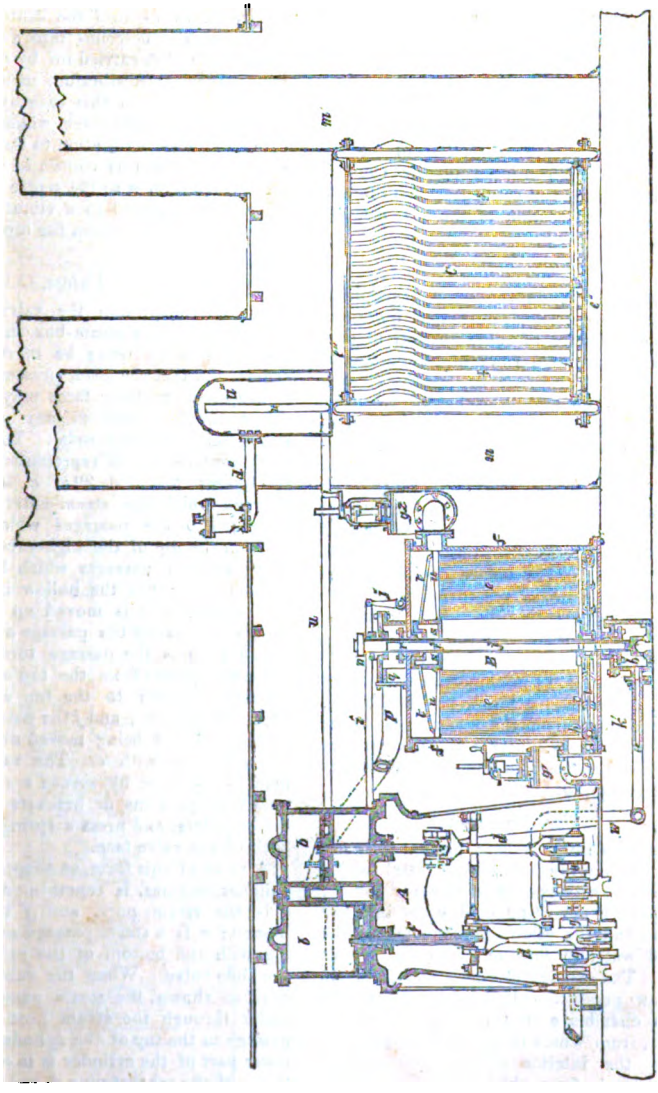
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1254.] SATURDAY, AUGUST 21. [Price 3*d*.

Edited by J. C. Robertson, 166 Fleet-street.

CRADDOCK'S HIGH-PRESSURE, EXPANSIVE, AND CONDENSING MARINE ENGINE.

Fig. 23.



Digitized by Google

MR. CRADDOCK'S HIGH-PRESSURE, EXPANSION, AND CONDENSING SYSTEM APPLIED TO MARINE ENGINES.

(In continuation from page 157.)

We now proceed to show the application of Mr. Craddock's system to the working by direct-action of Screw and other Sub-marine propellers, and shall first point out in what respects the arrangements in this case differ from those of the stationary engine described in a former number.

Fig. 23 is a longitudinal section of a pair of oscillating twin engines, boiler, furnace, and condenser—the whole of which are supposed to be placed on the same level; figure 24 a transverse section of the engines; figure 25 a plan of the engines, boiler, furnace, and condenser; and fig. 26 a longitudinal section of the boat and engines.

The Boiler.

The boiler is on the same principle as that before described, only that there are four quadrangles of tubes instead of one, and two additional rows of tubes, one on each side, as also four fire gratings (each divided in the middle as before) to correspond; and that the whole is enclosed in iron instead of being set in brick. A transverse section on the line $e^a f^a$ on an enlarged scale is given in fig. 27. Between the two outermost quadrangles and the additional rows of pipes R^1 R^1, there are spaces *b b* left which serve as substitutes for the brick flues in the furnace before described. At the two ends, these spaces *b b* widen into the larger flue spaces *c c*, which terminate in two funnels *d* and d^1; the former being elongated in one of its diameters to hold the steam chest, as in the arrangement first before described. *z z* is the pipe which conveys the steam from the steam chest to the high pressure cylinders *a a*. The furnace in this case is fed from doors at the side, as shown in fig. 25.

The Condenser.

The condenser is here placed within a cistern *f f* on the floor of the vessel, which is provided with two sluice valves g^1 and g^2; one (g^1) for admitting cold water into the cistern, and the other (g^2) for allowing the heated water to flow out into the sea or river. The exhaust steam passes from the two low pressure cylinders up the pipe *p* into a chamber *q* in the head of the condenser, from which it enters through slots *r* into the interior of the hollow central shaft *j*, from which it again emerges through similar slots r^2 into an annular receiver *s*, whence it is transmitted through the tubes *t t* to the radial arms *u u*, which distribute it among the various condensing pipes *e e*, as before described. At the bottom there are other radial arms *v v*, and a ring *h*, to receive the condensed water as before; and from the ring *h* it is returned by pipes *i i* into the central shaft *j* down which it descends into a receiver h^1 from which it is carried off by a pipe k^1 to the air-pump. A vibratory motion is given to the condenser in this case by the action of a weigh shaft and lever, which communicate an alternating motion to the rod *i*, one end of which rod is connected by a pin *l*, and slotted lever *n* to the centre shaft *j*, and the other is jointed to a vibrating arm j^2, which has its support on the top of the cistern f^1.

The Valves.

In this adaptation the valves *k k* are made without any steam-box in order that they may at all times be more ready of access, and that the back pressure requisite to keep them to their faces may be conveniently applied without any unnecessary strain on the valve-rods. The form of their construction is represented separately in figures 28 and 29; *a* is the port through which the steam enters from the boiler; *b b* are passages which lead to or from the top of the high-pressure cylinders; and *c c* passages which lead to the bottom of it; *k* is the hollow in the valve face which, as it is moved up and down, covers alternately the passage *a* and *b*, and *a* and *c*; *h* is the passage through which the steam passes from the top of the high-pressure cylinder to the top of the low-pressure cylinder; and *j* the passage which on the hollow *k* being moved over *a* and *c* communicates with *c*. The valve face is held to its place by screws *s s s s*, which pass through arms or brackets attached to the cylinders, and press a spring bar at the back of the valve face.

A valve of this form, as adapted to single cylinder engines, is represented in fig. 30. *a* is the steam port, and *f* the exhaust branch; *c* is a steam passage communicating with the bottom of the cylinder; *g* the slide valve. When the valve is in the position shown, the steam passes from the boiler through the steam port *a*, and the passage to the top of the cylinder, while the lower part of the cylinder is in communication with the exhaust pipe *f*, and the passage *e* with the steam port *a*.

Digitized by Google

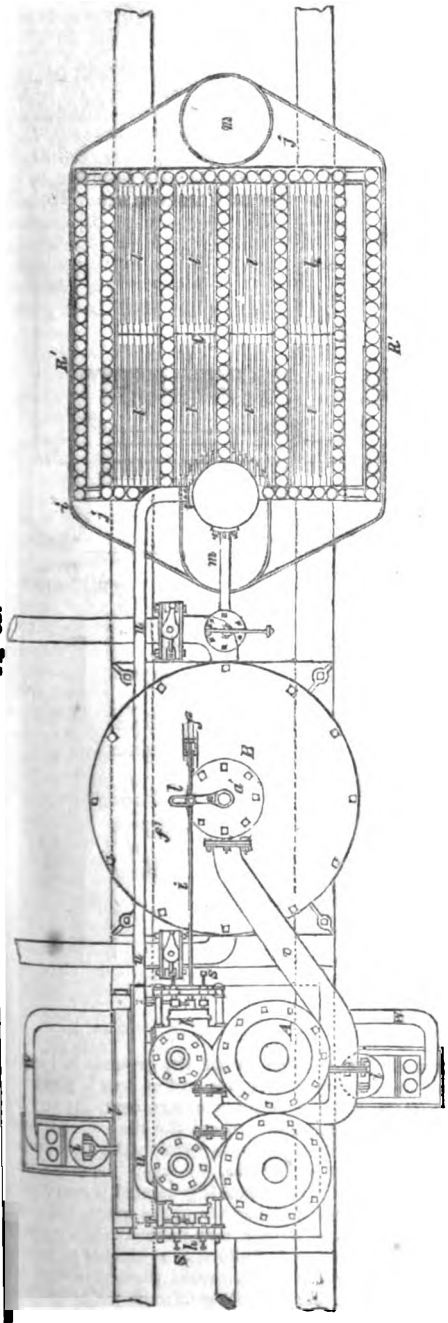


Fig. 26.

Digitized by Google

The peculiarities in this arrangement most deserving of attention are the following:

1st, The angular mode of connecting each pair of cylinders; whereby one valve, one eccentric, one cross-head, one connecting-rod, and one steam-box, are made to serve the purposes of both cylinders, and a proportional saving of weight and room is effected.

2d, The great simplicity and efficier of the "one valve," which is such as admit of the steam being cut off at a part of the stroke from one-half to o twentieth. According to the views wh Mr. Craddock entertains (*Chemistry the Steam Engine*) on the subject high pressure steam, this facility working it expansively becomes an (ject of the first importance. He is

Fig. 27.

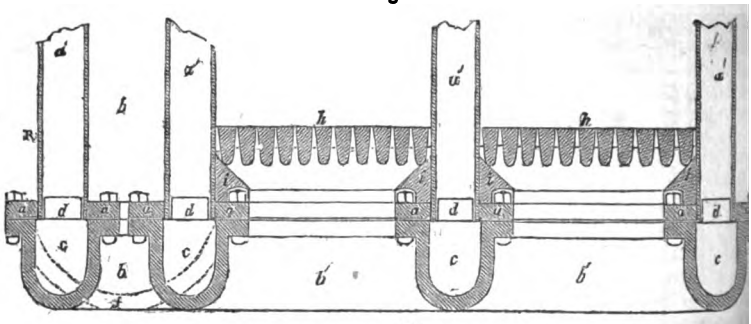


Fig. 29.

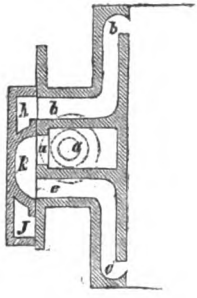


Fig. 28.

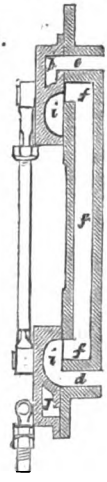


Fig. 30.

using it at a pressure in the boiler of not less than 115 lbs.—derides the idea of any danger attending it in boilers constructed like his, or, indeed, in any well-arranged boiler on the tubular plan—and anticipates that "many years will not pass before 200 lbs. pressure per square will be used."

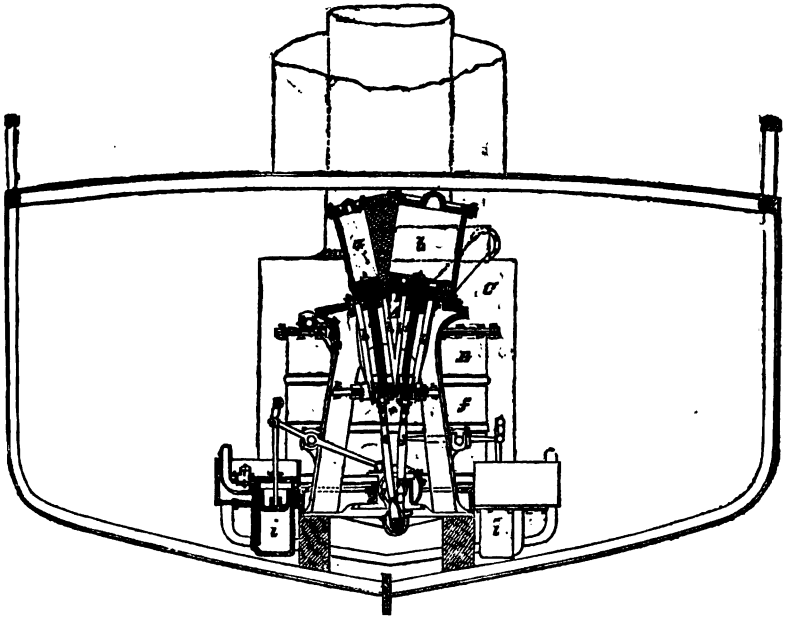
"One can scarcely forbear to smile at the complacency with which even 1000 lbs. pressure is proposed and received by the public, when that pressure is the result of compressed air. Yet, I must confess myself unable to see the grounds of co cency in this case, and of fear in the c which I propose a comparatively ve pressure for steam; for the air, under circumstances, is certainly the more da ous of the two, for when the water which the steam is generated is contai tubes, the danger from the water, under circumstances, may be said to be comp prevented, while steam partakes of m perty more dangerous than compress But here will occur to some the danger the heat of the steam; but it deserv be generally known, that the highe

Digitized by Google

pressure of steam previous to its rushing from a vessel, the lower becomes its temperature by its expansive force; and the mere heat of the steam, under such circumstances, is completely harmless. Another peculiarity due to steam, in common with other aëriform bodies, is this, that by the very dilated state of the particles of matter of which it is composed, it does not impart heat to, nor extract it from, other substances with anything like the rapidity of a liquid such as water; hence, a temperature which in water would be destructive to life, in steam or any gaseous medium can be borne with impunity for a considerable length of time, especially if the steam or gas be quiescent."

3rd, The immersion of the condenser in water. The system of condensation, with which Mr. Craddock's most obviously challenges a comparison, is the well known one of Mr. Samuel Hall's. We shall lay before our readers Mr. Craddock's own views of the advantages which he has realized over his rival, and without identifying ourselves with them, we may say that they are stated with candour and with great appearance of truth on their side.

Fig. 24.



"In making a comparison with Mr. Hall's plan, I shall first quote as far as I can from his own data. First he gives 60,000 inches of steam per minute at 4 lbs. upon the inch above the atmosphere, as the quantity necessary for the production of one horse power; from this quantity of steam, I hesitate not to affirm, that with the system I am here advocating, and with the condenser in water, we can produce *three* horse power. Mr. Hall next gives 20 square feet of surface in the condenser, as that requisite for the condensation of this quantity of steam per minute; whereas, by giving the condenser motion in water, in accordance with my principle, we can effect this amount of condensation with 15 square feet of surface. We have thence a reduction of the amount of surface requisite for the condenser per horse power, from 20 feet to 5 feet. The next peculiarity of Mr. Hall's plan is, the moving of 10 gallons of water per minute per horse power, by means of a pump or pumps, through or amongst his stationary condensing pipes, which are studded as thickly as possible into plates at top and bottom; these plates being enclosed, a steam-chamber is formed at the top, from which the steam passes through the pipes to another chamber similarly formed at the

Digitized by Google

bottom; from thence the condensed steam is drawn off for the use of the boiler. The joints of Mr. Hall's condenser are what are termed packing-joints, without any provision for expansion and contraction, otherwise than by the tubes moving to and fro through the packing-joint. Without intending to call in question the efficiency of this joint in water, I can speak from experience, that it is utterly valueless in obtaining a vacuum when condensing with the atmosphere, as I made use of Mr. Hall's joint when I commenced making my condensers; but I found that, however well made, and tight when first put in action, it remained so but for a few days, when I found it impossible to keep a vacuum, and was obliged to take the condenser to pieces, and to make provision for expansion, by bending the tubes, and also to make the joints in the manner shown in fig. 14. The end of the tube and hole in which it is inserted are first tinned, the tube is swelled out on the one side, and flanged over on the other; each of the leaves, when made, is simply dipped in a cistern of melted tin; the joinings are then complete, the metals being united. So simple and effective is this joint, that I think I could undertake, without hesitation, to make 1,000,000 of them without a leaky one; but this is not their only advantage compared with Mr. Hall's joints, as they are made at one-tenth of the expense.

"In contrasting my condenser with Mr. Hall's, *seven* items of essential moment stand in a very different relation.

"The *first* is, that by using high-pressure steam expansively, I have but one-third the quantity to condense for the same amount of power.

"*Secondly*, owing to the motion I give to the condenser in liquid, not only will there be less absorption of power, than in drawing or forcing the water by means of pumps, as in his case, but a much more rapid abstraction of heat will ensue from the greater rapidity and uniformity with which the particles of the water will be brought into contact with the hot surface.

* * * *

"Here is surface brought into contact with many tons of water in a very short space of time by the power of one horse. I may ask, could this mass of particles of water be in any other way so easily brought into contact with this surface?

"In giving motion to the condenser, I avail myself of the law by which fluids expanded by heat are forced upwards by colder portions of the same, which are continually rushing in to supply their place. I therefore place the condenser in such a manner as to communicate at bottom with the cold water of the ocean, while at top the heated water is allowed to flow away. The condenser being put in motion will bring into rapid contact with its hot surface the particles of water surrounding it, and at the same time will assist the natural upward current before spoken of. This is my substitute for Mr. Hall's *third* provision, viz., pumps for removing or bringing the water into contact with his condenser.

"A *fourth* circumstance relating to Mr. Hall's condenser, is one which has been stated to me as an objection to it, viz., that in turbid waters, owing to the tubes being so thickly set together, the filth accumulates in the centre of the condenser, and thereby much impairs its efficiency; this is an objection I think most persons would be disposed to anticipate, who have closely watched the effect of any obstruction to water moving through or along solids, as may be observed in the current of rivers. * * * Therefore, when we consider the multiplicity of obstructing tubes, which, in Mr. Hall's condenser, destroy the motion of the particles of water ere they arrive at the centre, we see a reason for the objection, and also a strong probability that the mobility of the particles of water in the centre, is not such as its author would desire; while, in so far as this is the case, there is wanting one essential condition for the quickest abstraction of heat.

"*Fifthly*, I have shown the greater simplicity and tightness of the joint I use.

"*Sixthly*, as I dispense with pumps for moving the water, I also save their expense, room, and weight.

"*Seventhly*, I have heard, as an objection to Mr. Hall's condenser, that it is a difficult matter to detect a leaky tube, when such may exist, and that the tubes are somewhat difficult of access in case of repairs. Now, I most completely meet this objection; for in my case, the condenser is put together in separate leaves, each leaf being connected by two screw pins and a union joint; we have only to undo these, when we can take out any individual leaf, the condenser in other respects remaining as efficient for the purpose as before; while, with the leaf so out, we have as great convenience for soldering or repairing it as can be required. This objection, I feel assured, is so effectually met, as to silence the most prejudiced against this mode of condensation."

Mr. Craddock indulges in a calculation, excusable enough, of the national advantages which would be realized were his system only generally adopted:

"To come as close as possible to practical comparison, we will suppose the engine-power of the *Great Britain* steam-ship to be 1200 horse. We will suppose steam used

Digitized by Google

expansively, and generated in tubular boilers, under a pressure of 115 lbs. per square inch. Now, it is beyond a question that steam so generated, and used expansively, will produce *double* the amount of power from any given weight of coals consumed for its production, which it will produce if generated under a pressure of only 18 or 20 lbs. on the square inch.

* * * *

"If we, therefore, suppose a voyage to and fro, between Liverpool and New York, to occupy 672 hours, and to produce a saving equal to 828 tons of coals, at a cost of 10*s.* per ton, we have here a saving of 414*l.* sterling. But the saving would be even greater than this in the reduction of the useless freight, consequent upon the diminished quantity of coals, with very much less weight and bulk of machinery. I firmly believe that the saving here would be twofold the mere saving arising from the consumption of a less quantity of coal. But I will take it at 414*l.* also, or a clear gain equal to 828*l.* sterling, upon each voyage to and fro, between the above-named places. Supposing eight such voyages in the year, the saving would amount to 6,624*l.* sterling.

"*If this be the saving which would be realized in one steam-vessel per annum, it is difficult to calculate what would be the saving from the application of such principles to all the marine steam-engines, even in Great Britain—not to speak here of its application to the various countries of the world.*"

"Difficult to calculate" indeed! May but one twentieth part of the saving assumed be realized, and not only will the nation and the world be everlastingly indebted to our ingenious and enthusiastic friend, but Mr. Craddock himself (if he but experience the same share of fair play—indifferent as it was—of his great precursor WATT) secure to himself a most enviable harvest of profit and renown.

[The adaptation of Mr. Craddock's system to Railway Locomotives in our next or succeeding Number.]

YACHT SAILING.

Sir,—Having observed in the 1249th number of your Magazine that Mr. John MacGregor wishes that some of your nautical correspondents would throw some additional light upon the setting of yacht's sails, and more particularly their jibs and fore-sails; I presume to make the attempt from a feeling of conviction that few persons have entertained the subject equally with myself.

In allusion to jibs, it must first be perfectly understood that all jibs and stay-sails are very imperfect sails, by reason of their luffs being partly in a horizontal direction, and not in the plane of their feet and after-leaches. This imperfection is null when the fore-leach, or luff is in the perpendicular direction, and greatest when it is in the horizontal one, when the sail (if it were the form of an equilateral triangle) would have no propelling power *whatever* endways. The evil, then, is in proportion to the angle which the luff of the jib makes from the perpendicular, or the mast. Practice has detected the evil (perhaps without knowing the cause), and sail-makers by their ingenuity have done their best to correct it. Thus, by way of reducing the lateral pressure of the sail, situated near the luff, they allow it to belly there, as shown in Mr. MacGregor's fig. 1. Now, although my notion is that a sail should stand as flat as a board, according to Mr. MacGregor's fig. 2, yet I affirm that as a jib does not move in a plane, the sailmakers' correction was judicious by diminishing the lateral and non-effective propelling power of the sail. If Mr. MacGregor will cut a flat and thin board to the shape of his jib, stick two pins about one-third from the fore port on the luff and foot, so as to admit the jib to turn upon an axis there, he will clearly see, not only what I mean by a perfect movable plane, but at once appreciate all its advantages over the present jibs and fore-sails. In fact, I am greatly indebted to that quality for the superiority of my revolving masted rig in sailing close hauled, which so far surpassed my expectation that the discovery of the cause followed after the invention. The other principal cause is, that the weights of the revolving rig are balanced, there being as much weight over to windward as to leeward; whereas all other "fore and aft" rigged vessels have the weights of their sails and spars over to leeward, to the great diminution of their stability.

With regard to a cutter's main-sail, the ingenuity of sailmakers has also lessened its imperfections. They will understand the evil of a taut after-leach, which causes the sail to belly towards it. By their manner of gradually sew-

Digitized by Google

ing the seams of the cloths slacker and slacker as they approach the after-leach, they have succeeded in making the sail stand tolerably flat at the expense of some loss of power by the shaking of the after-leach.

My aim has been to find out the most perfect sail for going to windward, even if such a sail should be impracticable on a large scale. The result of my endeavours is, that a sail should be perfectly flat from the fore end to its centre, and then that it should gradually bend in a parabolic curve to leeward, so as to be convex, or (to use a more familiar term) belly to windward. This convexity may be too great, but kept within certain limits, it is by far the best form; and if the sail could be made so as to spring with the vessel's motion and the unequal puffs of wind, it would still more approach to perfection. I have put it into operation as far as was practically possible, by making a triangular sail with the after-leach, forming an arc of a circle, and so maintained by the help of spreaders radiating at equal distances from the fore part of the sail, thus forming the sail on the principle of a bat's or butterfly's wing. These spreaders being elastic, caused the sail to belly to windward in the way I have mentioned. Although the bat and butterfly principle of cutting sails may not be practicable (except in Chinese junks) on a large scale, on account of the greater weight and non-elasticity of spreaders; yet it is useful to nautical science that the nearest approximation to what a sail ought to be, should be known and understood, and then let practice do its best.

I hope I have sufficiently intruded upon your pages to give some satisfaction to Mr. MacGregor; at any rate, I think my ideas will be found novel to him. I am, Sir, yours, &c.,

MOLYNEUX SHULDHAM.
Commander, R.N.

Boulogne-sur-Mer, August 16, 1847.

"CAN A BALLOON ASCEND IN VACUO?"—MR. MACGREGOR IN EXPLANATION.

Sir,—I gladly admit that the meaning which I erroneously attached to the words of "A. H." in a former communication, page 4, was not that which he intended them to convey. The fault of misconception was probably mine, and not one consequent on obscurity in the passage referred to. The expression "called into play an external force," appeared to me to apply the word *external* to a simple re-action, which, though certainly dependent upon external circumstances for existence, is no less dependent upon forces internal (in the machine) for its exhibition. I properly reserved myself for further explanation, and to promote this, proposed a case where, at the instant of the first action of the internal force, there is no external force in being. As to the stability of the centre of gravity, I, of course, assent equally with "A. H." to the acknowledged law; but I think that he will allow, that in his statement, at page 4, he has so worded the two cases, as to lead us to infer that when the board is removed, a new force is called into play.

I am, Sir, yours, &c.,
JOHN MACGREGOR.

Battersea, Aug. 15, 1847.

THE BRITANNIA TUNNEL BRIDGE OVER THE MENAI STRAITS.—GENERAL PASLEY'S LETTER AND MR. STEPHENSON'S REPLY.

General Pasley addressed lately a letter to the *Times* in which he made the following statements in reference to this structure; we give them in a somewhat abridged form:

As it is well known, that when examined before a select committee of the House of Commons on the sixth of May, 1845, on the means of passing the Chester and Holyhead Railway over the Menai Straits, I approved of the tubular bridge then proposed by Mr. Robert Stephenson, engineer of that company, I think it is a duty to myself, if not to the public, to offer some observations on the various projects for effecting the same object, successively brought forward by him, or which that alluded to was the second.

In his first plan, February, 1845, Mr. Stephenson proposed to throw a massive substantial bridge, with two segmental cast-iron arches, each of 350 ft. span, over the Menai Straits, having a clear height above the water of 116 ft. in the centre, and of 50 ft. at the springing of each of those arches, which were to be supported by an intermediate pier of masonry 120 feet wide, on a shoal called Britannia Rock, and on two abutments, also of masonry. His plan of operation for putting the pieces of iron for his arches together successively, so as to balance each other, by working outwards from the upper part of the pier and of the

Digitized by Google

abutments, until his semi-arches should meet at the centre of each opening, seemed to me to be crude and ill-digested at the time, and either impracticable, or nearly so. I gave Mr. Stephenson my opinion, that, in consequence of the impossibility of obtaining any support from below, a suspension bridge, such as that previously erected by Mr. Telford over the same straits, which being everywhere 100 ft. high, offers no impediment to the navigation, and having in its present state strength enough to bear the weight of the heaviest railway train, but not with safety, owing to the flexibility and extraordinary undulations of the roadway in a gale of wind, might be rendered efficient for all railway purposes by four vertical trusses, one on each side of the two lines of rails, which, if of sufficient depth, would produce that rigid inflexibility of roadway, without which no railway bridge can be considered safe; a principle first adopted by Mr. Tierney Clark in the construction of the suspension bridge at Hammersmith, and more recently by Mr. Rendell, with no less success, in his repairs of the suspension bridge at Montrose, after one-third of the roadway had been carried away by a storm, on the 11th of October, 1838. I further suggested to Mr. Stephenson, that a suspension bridge for passing a railway over the Menai Straits might be trussed to advantage by wrought-iron lattice work, such as Sir John MacNeill had adopted for passing the Dublin and Drogheda Railway over the Royal Canal near Dublin, by a bridge of 140 ft. span. Afterwards the Lords of the Admiralty employed Sir John Rennie and Mr. Rendell, civil engineers, and Captain Vidal, R.N., to examine that part of the Menai Straits where the railway bridge was proposed, and to consider what conditions they thought necessary to prevent the navigation from being injured. On receiving their report, the Admiralty required that the Chester and Holyhead Railway Company, in making their bridge over the Menai Straits, should not construct the central pier on Britannia Rock wider or longer than 50 feet, and that there should be two openings between it and the abutments, each 450 ft. in clear width, and everywhere to be of 105 feet in clear height above high water level.

Mr. R. Stephenson's second plan, when thus obliged to withdraw the former, was to erect a suspension bridge of the usual construction, in order to obtain a platform for his further operations as I had before suggested. But the sort of bridge which he now proposed to put together by this means was of a novel and very ingenious construction, consisting of two large tubes of boiler iron, elliptical in section, and each measuring 30 feet by 15, in clear height and width; and he proposed that these tubes, though resting on a central pier of masonry, were to pass entirely across the Straits from one side to the other. Observing the conditions prescribed by the Admiralty, it is evident that they could not be much less than 1,000 feet in length, when finished.

On the 5th of April, and afterwards on the 6th of May, 1845, Mr. R. Stephenson admitted, in examination before the Select Committee of the House of Commons, that the above was the only possible mode of throwing a bridge of such large openings over the Menai Straits, but he had so much confidence in the strength and rigidity of his proposed tubes, that, after they should be placed he thought the suspension apparatus might be removed with safety. When I was examined by the same Committee, on the last-named day, I gave my opinion that the tubular bridge proposed by him would be strong and safe; and that when properly fixed, it would not be injured by gales of wind, though I was not convinced that such tubes would be better than vertical trusses; but I differed entirely from the suggestion Mr. Stephenson had thrown out, as to the expediency of removing the suspension apparatus—a measure which I thought would not only be unnecessary, but that it might endanger the security of the bridge.

From this, his second project, Mr. Stephenson has since departed, having been induced to give up elliptical and adopt rectangular tubes, in consequence of experiments tried, at his request, in 1846, by Mr. W. Fairbairn and Mr. E. Hodgkinson, both very experienced and skilful in the uses of iron, as applied to practical architecture and engineering. Not so, the decision afterwards adopted by Mr. Stephenson, of abandoning the suspension principle altogether; instead of which he now proposes to put together in succession each of his tubes, which, according to this new arrangement, will be four in number, on a bridge of boats, which will first be formed parallel to the shore, and will then be swung into the proper transverse position by the quarter-circle movement, common in the practice of military bridges, after which the tube is to be suspended by chains; and though either of the sides will expose to the wind a surface of at least 1,400 square feet, considerably exceeding the area of all the sails of a 28 gun ship, and will weigh, as I am told, about 1,200 tons, each of these unwieldy masses is to be raised up nearly 100 feet by hydrostatic pressure, and thus deposited and fixed on the lofty pier and abutment of masonry. I feel it my duty to express my entire dis-

Digitized by Google

sent from this rash, if not impracticable, plan of operation, which cannot even be attempted without the risk of some very serious disaster, except at the high water slack of a neap tide, and in a perfect calm.

He has now, to my knowledge, proposed three projects, which have just been described, all widely differing from each other, for passing the Chester and Holyhead Railway over the Menai Straits; and I think that his second plan, the only one which I approve, would have been sufficiently arduous in itself without adding to the difficulty, and diminishing the safety, of the attempt by the abandonment of the suspension principle; if he persists in this, his third plan of operation, the chances are, that the first tube which he attempts to raise will find its way to the bottom of the straits.

Since the publication of General Pasley's letter, there has been a meeting of the Chester and Holyhead Railway Company, at which Mr. Stephenson replied to the General in the following terms. We quote the *Railway Record's* report:

"General Pasley makes only a statement, or rather gives a detail of conversations which took place between us relative to the principle of the use of iron-tube bridges. General Pasley states that at first he approved of the principle adopted by me, and there is not in his letter one paragraph to condemn that principle—nay, he distinctly repeats that he approves of the principle. What he complains of is the mode of erecting the tube. Now, Gentlemen, there are only two or three persons who know the facts connected with the mode proposed, and General Pasley cannot possibly be in possession of any information which can at all justify his prediction. (Hear, hear, hear.) The original plan was to use chains to raise the tube to a level with the platforms of the railway, which chains could be removed when the tube was fixed. Afterwards, we altered the mode of raising the tube; and it is only to this mode about which General Pasley cannot know anything—for, as I have said, it has been confided only to two or three persons—that objection is taken. I believe any apprehensions that may be entertained are of a very vague character, and that it is mainly the novelty of the plan which gives rise to such apprehensions. I believe the objections have nothing in them; the plan is only an application on a gigantic scale of an old principle.

I beg to say, Gentlemen, that they have created no apprehension whatever in my mind; they have not altered my convictions in the slightest degree: and though, as in all great works, difficulties doubtless will arise in the course of their execution, these difficulties, I am satisfied, will only be such as will suggest the remedy as they occur. (Hear.) I believe nothing will occur which we shall not be able to correct. I shall myself be on the spot; and I repeat, that though I never knew any great work of any kind in which difficulties have not arisen, I entertain no doubt that in this case they will be readily surmounted. (Hear, hear.) I beg, therefore, that the proprietors will dismiss all apprehensions on this point from their minds. The scheme involved long and experimental investigations, exceeding anything that had ever taken place before; but I felt that a large expense was fully justified to test and settle the details of the bridge. (Hear, hear.) I believe we have so settled the matter; and I have reason to know that the most eminent engineers and mathematicians approve of the principle. (Hear, hear.)

Mr. HENMAN had understood General Pasley's objection to be, that Mr. Stephenson now intended to abandon the suspension principle which he had originally fixed upon. Now, he would be glad to know if Mr. Stephenson was of opinion that the tube, being of so large a span as 450 feet, would be able to bear the trains, and withstand the vibration, without support from chains at intermediate points.

Mr. STEPHENSON.—I wish it to be distinctly understood that I never designed the chains should form an essential part of the permanent structure; they were originally proposed, not for supporting the tube, but for raising it. As we proceeded, I found that, by increasing the weight and size—or rather, I should say, the weight only, for the size has never been altered—we could dispense with the chains altogether. I believe that it may be looked upon as fully settled, that, as respects the strength of the bridge, the chains would rather be a deterioration than otherwise. As regards vibration, there are certainly various opinions; but, for my own part, I think that no vibration at all will be felt. (Hear, hear, hear.) My reason is, the relative ratio of the weights of the tube and the trains. Take, for instance, a train of even 100 tons, then, as the tube is to be 1,200 tons weight, I ask whether, with such relative weights, the tube is likely to be thrown into vibration? I say it is impossible. If the ratio of weights were reversed—if, for instance, the train should be 1,200, and the tube 100, such vibration, would, undoubtedly, arise. I believe that the tube will be as firm as a rock—that it will suffer no vibration at all; at least, not

Digitized by Google

more than everything does over which a train passes. (Hear, hear.)

We quote the following description of this stupendous work, in its present state of progress, from the letter of a correspondent of the *Manchester Examiner*:

"If we suppose ourselves stationed in a boat in the middle of the Menai Straits, a few hundred yards distant from the new bridge on the south side, and suppose it finished, we shall see a wonder of the world of this kind. First, there is the middle pier rising out of the water, founded on the Britannia Rock, after which the bridge is named. This rock can be seen at low water. The breadth of this pier is 62 feet by 53 feet and a quarter of an inch. The blocks of stone are 7 and 8 feet long by 3 and 4 feet in breadth and deepness, and they rise, stone upon stone, until the pier is 230 feet high. At the distance of 460 feet on each side of this centre pier there rise, near the water's edge, two other piers of the same gigantic breadth and height; while on each side of these two piers, at the distance of 250 feet, there rise two walls. Continuing outwards, the wall on our right hand, on the Carnarvon shore, does not extend its ponderous bulk far back, for the land is high and bold, and the railway comes along its elevated brow, and at once lays hold of the bridge. But on our left hand, which is the Anglesea shore, the wall is the forehead and end of a mighty embankment, on which the railway is raised to the level of the bridge. There, then, are the four spaces before us, across which, in the iron tubes, the railway is laid, namely, two spaces on each side of the centre pier, of 460 feet each (let the reader measure 460 feet on a street or on a road, and he will wonder at the vastness of this structure); and two more spaces, of 250 feet respectively, at each end. The tubes are eight in number, each of them 30 feet on the exterior side, and 27 feet high in the interior. Each is 14 feet wide, and they are laid in couples parallel to each other. In the whole, with the breadth of the piers and the landward buildings, the length of the bridge is one-third of a mile. In height the three piers are, as already said, 230 feet. Measuring from low-water mark to the bottom of the tubes, the height is 130 feet, the tubes being 30 feet on the side, and the pier 70 feet above their upper surface. As ornaments to the two walls which rise upon each shore, are four lions, two at each end of the bridge. The lions contain about 8,000 cubic feet of stone. They lie couched, and yet the height of each is 12 feet; the greatest breadth across the body is nine feet, the length 25 feet, the breadth of each paw two feet four inches. The tubes are made of plates of iron of various thicknesses, riveted together. The iron increases in thickness as we proceed towards the centre. The roofs of the tubes are formed of cells, and also the floors. These cells are formed of iron plates set on edge, the cells of the roof being within a fraction of one foot nine inches square, and those of the floor being one foot nine inches wide, and two feet three inches deep. The rails on which the trains run are laid on the cells of the floor. The flat bottom, the two upright sides, and the flat roof of each tube are formed of plates, the thinnest of which is a quarter of an inch, and the thickest three quarters of an inch. The weight of each of the four long tubes will be about 1,300 tons; the weight of each of the four short ones, about 600 tons. In the whole, there will be at least 7,600 tons of iron used. The masonry was contracted for by B. J. Nowell and Co., at 130,000*l.*; but, from alterations in the plans, it will cost 200,000*l.* They expect to finish the masonry by August, 1848. It will contain 1,500,000 cubic feet of stone."

TIMBER MINING IN AMERICA.

On the north side of Maurice River Creek, New Jersey, the meadows and cedar swamps, as far up as the fast land, are filled with buried cedars to an unknown depth. In 1814 or 1815 an attempt was made to sink a well curb near Dennis Creek Landing, but after encountering much difficulty in cutting through a number of logs, the workmen were at last compelled to give up the attempt by finding, at the depth of twenty feet, a compact mass of cedar logs. It is a constant business near Dennis Creek to "mine cedar shingles." This is done by probing the soft mud of the swamps with poles, for the purpose of discovering buried cedar timber; and when a log is found, the mud is cleared off, the log cut up into proper lengths with a long one-handled saw, and these lengths split up into shingles and carried out of the swamp ready for sale. This kind of work gives constant employment to a large number of hands. The trees found are from four to five feet in diameter; they lie in every possible position, and some of them seem to have been buried for many centuries. Thus, stumps of trees which have grown to a greater age, and which have been decaying a century, are found standing in the place in which they grew, while the trunks of very aged cedars are lying horizontally under their roots. One of these instances is thus described in a manuscript from Dr. Beesley, of

Digitized by Google

Dennis Creek, who has himself "mined" many thousand cedar shingles, and is now engaged in the business:

"I have in my mine a cedar some 2½ feet over, under a large cedar stump, 6 feet in diameter. Upon counting the annual growths of the stump, I found there were 30 of them in an inch; so that there were 1,080 in the 3 feet from the centre to the outside of the tree. The stump must thus have been 1,080 years in growing. To all appearances the tree to which it belonged has been dead for centuries; for after a stump in these meadows decays down to the wet, there is no more decay—none at least that is perceptible. Now we have 1,080 years for the growth of the stump, and 500 for its decay, and 500 for the growth of the tree under it; for this must have grown and fallen before the tree, to which the stump belonged, sprouted. We are thus carried back for the term of perhaps 2,000 years, of which 1,500 are determined, beyond question, by the growth of the trees."

The better opinion is that these trees have gradually sunk through the soft mud of the swamps, after having attained their growth and fallen. Many, however, have decayed in their erect position, for the swamps are full of stumps standing as they grew.

Within a short distance of the mouth of Dennis Creek, and about three miles from any growing timber, can be seen at low water, in the bed of the stream, numerous cedar and pine stumps, about 6 feet below the surface of the meadow, with the bark still adhering to some, when the mud is removed. As one passes up the creek a few miles the stumps approach the surface, and near the edge of the live swamps they become very numerous.—*Scientific American.*

SINGULAR MAGNETIC ATTRACTION OF MUD.

Sir A. Mackenzie was the first to notice the attractive power of the mud at the bottom of some of the lakes of North America, which is sometimes so great that boats can with difficulty proceed along the surface. This extraordinary fact is thus stated:

"At the portage or carrying-place of Matrees, on Rose Lake, the water is only three or four feet deep, and the bottom is muddy. I have often plunged into it a pole twelve feet long, with as much ease as if I merely plunged it into the water. Nevertheless this mud has a sort of magnetical effect on the boats, which is such that the paddles can with difficulty urge them on. This effect is not perceptible on the south side of the lake, where the water is deep, but it is more and more sensible as you approach the opposite shore. I have been assured that loaded boats have often been in danger of sinking, and could only be extricated by being towed by lighter boats. As for myself I have never been in danger of foundering; but I have several times had great difficulty in passing the spot with six stout rowers, whose utmost efforts could scarcely overcome the attraction of the mud. A similar phenomenon is observed on the lake Sagina, where it is with difficulty that a loaded boat can be made to advance, but fortunately the spot is only 400 yards over."

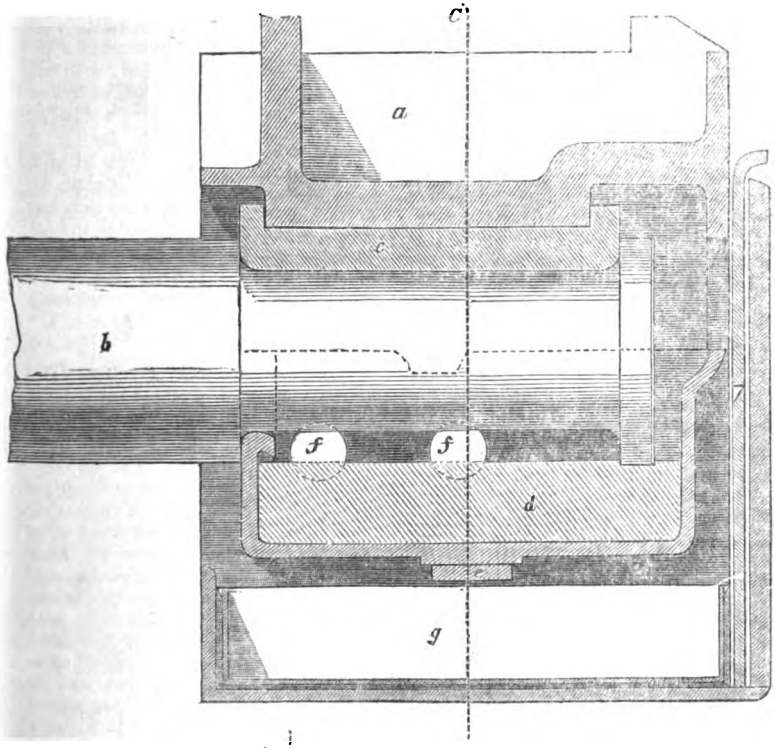
This statement has since received confirmation from Captain Back and others, during the arctic land expeditions.

MALLET'S PATENT AXLE BEARINGS.

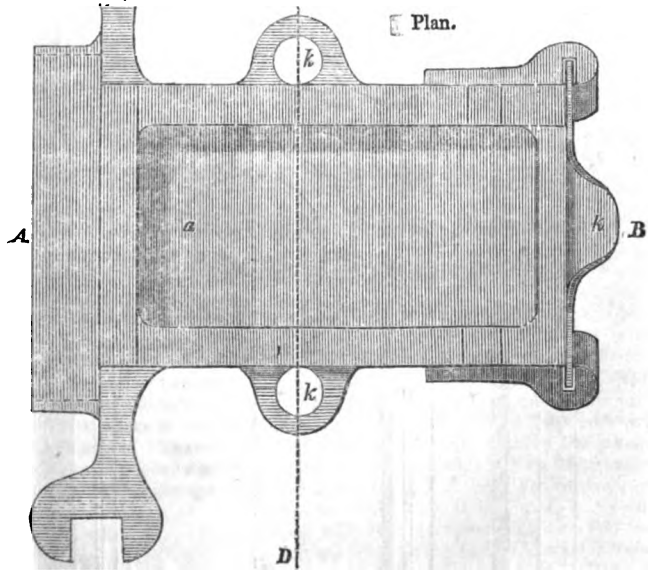
The peculiarity of these axle-bearings consists in a novel and exceedingly ingenious method of keeping them continually oiled or lubricated. It is applicable to all sorts of revolving and rolling cylindrical surfaces, but more especially to the axles of locomotive engines and railway carriages. The patentee (Mr. Robert Mallet, of Dublin, a gentleman alike eminent for his philosophical attainments and mechanical skill) places at a suitsble distance, below the journal or rubbing surface to be oiled, a vessel containing oil or other fluid unguent, and several small balls or spheres, of such specific gravity, that they may float on the surface of the oil. These balls or spheres may be of cork or light wood; or, if made hollow, they may be made of glass, or metal, or porcelain. The size of the floating bodies is such, and the distance from the lower side of the journal to the surface of the oil is so adjusted, that the floating bodies shall always be in contact with the lower side of the journal, or with some part of it very near its lowest part. When the journal or cylindrical axle is now caused to revolve in either direction upon its own axis, the slight friction between its surface and that of the floating bodies is sufficient to cause these to revolve also. They thus lick up (as it were) the oil, or other fluid in which they float, and continually apply it to the under surface of the revolving axle or journal. The superfluous portion of oil so applied to the axle or bearing, is swept off by the top brass or metal in which the axle or journal is placed for the upper half of its circumference, at the side towards which the surface of the

Digitized by Google

Section on the line A B.

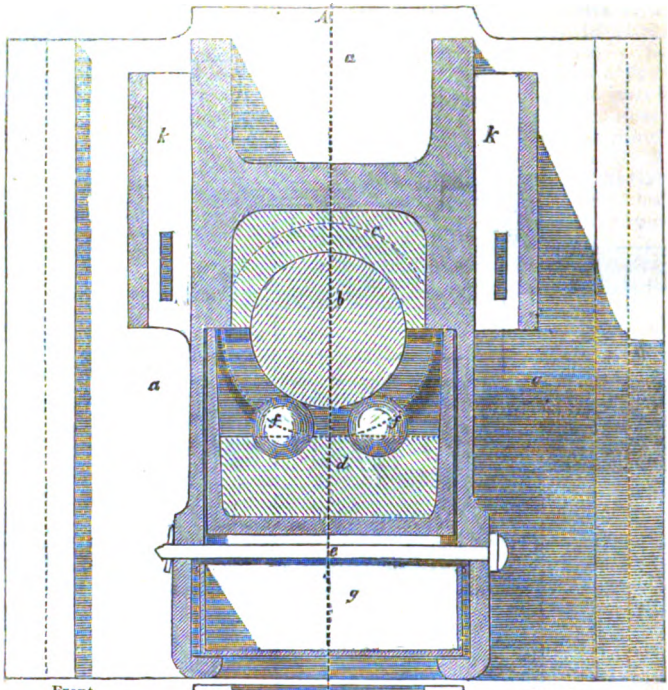


Plan.

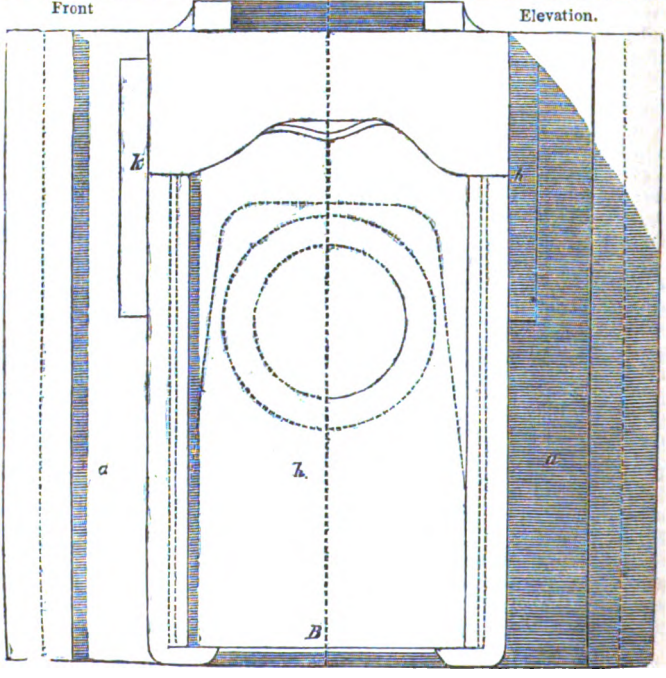


Digitized by Google

Section on C D.



Front Elevation.



Digitized by Google

axle or journal revolves, and from which it drops back again into the dish or vessel of oil beneath.

The advantages of this contrivance are: that oil is thus constantly and uniformly applied to the axle, or journal, or shaft, and with a rapidity exactly proportionate to its own velocity of revolution; that there is scarcely any waste of oil; that the cleanest and best part of the oil is that always in use; and that the arrangement is so simple as not to be liable to get out of order, and admits of examination of the state of the axle and oiling apparatus at any moment.

The accompanying figures represent the details of an axle-box and bearing brass, fitted with this improved oiling apparatus in the way that Mr. Mallet considers most suitable for railway locomotives and carriages:

a is the cast iron axle-box, formed so as to slide in the usual axle guard; *b* part of the axle of a railway carriage in place; *c* is the brass bearing, or pillow of metal, in which the axle journal revolves; *k k* are holes for bolts by which the axle-box is fixed to the bearing spring of the carriage; *d* the oil vessel, which is preferred to be made of cast iron; its edge rises as high as the horizontal diameter of the axle journal, and meets the lower edge of the brass bearing or pillow *a*. At the end next the wheel of the carriage, the edge of the oil box embraces the lower half of the axle journal, but projects beyond the axle altogether at the other or outer end, so as to allow of oil being poured in, and of the journal being inspected upon drawing up the front slide of the plate iron (*h*). The oil box *d* is secured in its place by a cotter, or wedge, *e*, which is very slightly bent before being driven across, so as to bear hard, and with a little elasticity, against the underside, or bottom of the oil box, at the middle of its length: *f f* are the balls or spheres, floating in and upon the oil, and in contact with the lower part of the axle *b*; *g* is a tray, or box of copper, or of tin plate, which slides into its place in a rabbate cast on the lowest part of the axle box, and is secured there by the slide *h*. The office of this tray is to catch any small quantity of oil that may escape from the oil box *d*, or from the axle, and from this tray it may be returned readily into the oil box for further use. The floating bodies may be of the shape of almost any solid of revolution, but that of the sphere is preferred.

Voice from the Throne.

The Queen's speech, at the proroguing of Parliament, was transmitted from London to Norwich, a distance of 126 miles, in less than fifteen minutes.

Effect of Storms.

A storm, nearly unparalleled in violence, raged on the Atlantic coast on Saturday last (28th March). Since the introduction of magnetic telegraph lines, no event has occurred so discouraging to the enterprising proprietors thereof, as the destruction and prostration of their posts and wires, occasioned by this storm. From New Brunswick, N. J., to Philadelphia—about 50 miles—there were very few posts left standing. Many were broken off above the ground. But the circumstances were extraordinary, and would not be likely to occur again in a hundred years, if ever. The sleet ice is said to have accumulated on the wires to the thickness of an inch; and when some of the posts, being loosened by the rain, had fallen, their tendency was to break down the next, by straining on the wires. It has ever appeared to us a better policy to use shorter posts, and more of them to the mile. By doubling the ordinary expense of erection, they will be permanent and safe.—*Scientific American.*

Communication of True Time.

The Electric Telegraph Company are now making arrangements to communicate the true time, as observed daily at the Royal Observatory at Greenwich, to every station on the various lines of railway where the Company has a telegraph station, and, of course, to all large towns throughout the kingdom. It is now the daily practice at Greenwich, at 1 P.M., to indicate the true time by dropping a ball from the upper part of the Observatory, which, being telegraphed to the Admiralty, and signalled to the shipping on the Thames, enables ships' chronometers to be adjusted. The Telegraph Company intend that the ball, immediately on being detached at the top of its fall, should strike a spring, which, connected with the various lines of electric wires of the Company, will instantly strike a bell at every station. Thus it is not only possible and practicable, but what, in all probability, will be a matter of daily experience ere very long—that before the ball at the Greenwich Observatory shall have reached the ground in its fall, the electric bell at Manchester will have struck and been set ringing; so that we shall know it is 1 P.M. at Greenwich before the ball announcing that fact has finished falling a few feet.—*Kentish Herald.*

Digitized by Google

Reporting by Electric Telegraph.

The services of the electric-telegraph have at length been called into requisition for the purposes of the press. The second edition of the *Manchester Times*, Aug. 7, 1847, contains a report of a public meeting supplied by the above means; and this, we are informed by the proprietors, is the first time that the electric telegraph has been made available for such a purpose.

The Corn Market and Telegraph.

The weather having been lowering and occasionally wet in the neighbourhood of Manchester during the last two days, and still showery this morning, the anxiety of the commercial classes to know how the agricultural districts were affected, led us to inquire if the electric telegraph was yet extended far enough from Manchester to obtain information from the eastern counties. By the prompt attention of Mr. Cox, the superintendent, inquiries were made at the following places; and answers were returned, which we append:—Normanton, fine.—Derby, very dull.—York, fine.—Leeds, fine.—Nottingham, no rain, but dull and cold.—Rugby, rain.—Lincoln, moderately fine.—Newcastle-upon-Tyne, half-past 12, fine.—Scarborough, quarter to 1, fine.—Rochdale, 1 o'clock, fair.—A glance at the map of England will show that the weather is fine in the chief districts of agriculture east and north of the midlands. —*Manchester Examiner.*

The Longest Line—as yet.

New Haven was put into telegraphic communication with Toronto, Upper Canada, recently, and messages were instantly exchanged between the two cities. The route is *via* New York, Albany, Rochester, Buffalo, and then crossing the Niagara River below the falls, passes round Lake Ontario to Toronto, the entire distance being *nine hundred miles!* The experiment was a most successful one, and the distance was overcome with as much apparent ease and promptness as between New Haven and Hartford. It was the longest distance ever traversed by the lightning in a continuous unbroken line.

Baying at the Moon.

The Emperors of Russia and Austria have forbidden any person or company to construct lines of magnetic telegraph in their respective dominions without their special permission.

New Position for the Ground Plates, and New Battery Solution.

James M. Lindsey, superintendent of the Philadelphia-office of the Atlantic and Ohio Telegraphic Company, some time since finding that the line worked badly, resorted to an experiment, which has been successful. Heretofore all lines have used a ground-plate connected with the battery, forming a ground circuit by this means. All the lines in Philadelphia exchange (five in number). Mr. L. thought this might be the cause of the difficulty—and resorted to the following: He disconnected the ground-plate from the battery and connected it with the roof of the building, simply by putting the end of the wire between the joint of the sheets of copper, since which time it worked well.

Mr. L. has also a solution which he uses —dispensing with the use of sulphuric acid in the battery altogether. It is used, it is said, on the Western Line, and where the battery formerly had to be renewed twice a week, with this one is not renewed but once a month. The decomposition of the zinc is very slight, yet the current is as strong, if not stronger, than with the sulphuric.

The above are stated to us as facts by a correspondent, and without comment are published, we believing that some counter current has been avoided by the experiment. —*Scientific American*, 10 *July*, 1847.

Should Governments have the Superintendence?

It has been by many recommended that Government should purchase the exclusive right of the magnetic telegraph, thus monopolizing the right of all telegraphic communication; and in view of *some* advantages to be derived from such an arrangement, we have felt inclined to favour it; but in view of the rapid extension of lines in various directions by individual enterprise, we are led to consider in a more serious light many objections to having the excellent facilities of telegraphic communication controlled by, and dependent on, a party favouring secretary or commissioner. It is true, that a considerable portion of the business of the Post-office department is likely to be superseded by the increasing facilities of telegraphing; but then the public will be incomparably better accommodated under a system of competition, than with a government monopoly. For example, supposing the telegraphic system to be under the control of Government, if a branch line were wanted to be extended to a village at a short distance from a main line, a similar obsequious and tedious process must be performed to obtain the privilege that is required now to procure the establishment of a new mail route: and to every such branch line the deputy agent at the junction of the proposed branch with

Digitized by Google

the main line, would be very likely to be opposed. We have already an example in the case of the Washington and Baltimore lines, to show that under the special control of government, favourites with extravagant salaries will be employed as superintendents, though, perhaps, less capable and attentive than others who might be employed by private companies at one-fourth the amount of salary. Moreover, the nature of the telegraph system is such as to require frequent extra exertion in forwarding messages to individuals, whether a ready and ample compensation was certain or otherwise; and this would be done, under a competition system, in view of the popularity of the line; but under a general government system, the agents or superintendents would feel and act more independently of any consideration but that of their responsibility to the department. And even the general system of management under acts of congress, and instructions from the post-master general, or other head of department, would not, in any probability, be so judicious, and consistent with the productiveness of the establishment and accommodation of the public, as under the control of men of more experience, and consequently better judgment, in practical business operations; for a man must be blind indeed, who cannot see that members of congress—a body composed principally of lawyers—have less knowledge of the ordinary business operations and requirements of the community, than a great majority of their constituents. Another consideration to be examined is, the probability that the government would be inclined to restrict the telegraphic facilities in favour of the post-office and mail operations, by the same rule that our state legislature has cramped and restricted railroad facilities to favour the more expensive and tardy operations of the canals. Government may, if it pleases, impose a tax on such telegraphic communications (or on those uttered verbally) as might be construed to be "mailable matter:" but the effect of such an act would be in a great measure proportionate to public sentiment with regard to the constitutionality thereof; but intelligence, like water, will constantly tend to flow in its most convenient channels.—*Ibid.*

Telegraphing of Coming Storms.

Professor Espy, so well known for his investigations into the theory of storms, proposes to add efficiency to his efforts, by the aid of the magnetic telegraph. By this means, in connexion with the information resulting from his previous inquiries, one of his chief objects will probably soon be attained,—that of ascertaining when a storm of dangerous magnitude commences, so that preparations for it may be made, both on the seaboard and in the interior.

Application to Fire-Engine Stations.

A novel project is on foot in the Common Council of New York to run a telegraph line from the fire look-out on the City Hall to each of the eighteen police stations, to give intelligence of the whereabouts of every fire, so that on hearing the great bell, a person in any part of the city can ascertain at the station-house where it is.—*Scientific American*, March 10th, 1847. [Anticipated in England; see *Mech. Mag.*, No. 1223, for Jan. 16th, 1847.]

The Proper Wire to be Used.

The directors of the New York and Buffalo Telegraphic Company, at their recent meeting in Utica, resolved to use in their operations an iron wire known as No. 10, weighing about 250 lbs. to the mile. The English companies adopt a wire called No. 7, which is much heavier and more lasting.

(*To be continued occasionally.*)

MESSRS. BRETT AND LITTLE'S ELECTRIC TELEGRAPH.

[Patent dated February 11, 1847. Specification enrolled August 11, 1847.]

The improvements claimed under this patent are ten in number. We shall give the claims in the words of the inventors; and such explanations of them as may be necessary to show their general scope also nearly in their own words.

FIRST CLAIM.

"We claim, as an improvement in electric telegraphs, the use of a ring, or piece of metal, partially magnetized, in combination with a reel or coil of wire, whereby, and wherein, the electric current so acts, that the motions take place in a direction transverse to the axis of the coil, and parallel, or nearly so, to the planes in which the wire, constituting the coil, lies."

The electric fluid is made to pass through a number of coils of fine wire, properly coated or covered with silk, or other suitable non-conducting material; which wire is wound round a flat reel, or reels, of ivory, or other suitable material. The ends of these fine wires are alternately brought into contact with the galvanic battery, by suitable arrangements, whereby the current is made to act on and give motion to a partially magnetized ring, or piece of metal, suspended and moving on a fixed centre in

Digitized by Google

a plane parallel to the side, or face, of the flat reel, about which the wire is coiled; that is to say, parallel to the planes in which the wire is so coiled; the motions of this partially magnetized ring being communicated to an indicator, or indicators, whose motions in connection with a peculiarly arranged dial-plate with symbols thereon, may be employed to designate letters, figures, or other conventional signals, and transmit intelligence by means of electricity.

The patentees say, "We wish it to be perfectly understood, that although we have described the foregoing, by the application of circular coils of fine wire prepared as above described, wound round or upon a flat circular reel or reels, in conjunction with a flat metallic partially magnetized ring, moving parallel with such coils of fine wire for the giving motion to inductors, by which letters, figures, or other conventional symbols are designated; the same motion can be obtained, and the same principle applied by other modifications and arrangements, but we prefer using and adopting the arrangement above described."

Several exemplifications of such modifications are afterwards given.

SECOND CLAIM.

"We claim, as an improvement in electric telegraphs, an indicator, or indicators, deriving motion respectively from a current of electricity transmitted through a coil arranged and acting on a partially magnetized ring or piece of metal, as above described, and the adaptation of such motions to communicating intelligence between distant places."

THIRD CLAIM.

"We claim, as an improvement in electric telegraphs, the adaptation of an indicator or indicators to a dial-plate, constructed and arranged as described."

On the dial-plate are two vertical columns containing numerals from 1 to 25. The centre of the plate is retained for the symbolic arrangement of letters and figures by which the whole of the letters of the alphabet can be designated. When the indicators are in a state of rest they are in an angular position; but when put in action they move to a position nearly vertical, but are prevented from passing the vertical line by a pendant bar. In transmitting a signal or signals the letters of the alphabet are designated by single or repeated motions of either of two indicators (right and left hand), or of both in conjunction. Thus the letter A which is placed opposite to fig. 1 is indicated by one motion of one left-hand indicator; the letter B which comes opposite to fig. 2 by two motions of the same indicator; the letter E by four motions, two left and two right; and so on.

FOURTH CLAIM.

"We claim, as an improvement in electric telegraphs, the working *two* indicators, so as to give the requisite motions by means of a *single* handle constructed and arranged as described."

FIFTH CLAIM.

"We claim, as an improvement in electric telegraphs for giving audible signals, the use of a ring or piece of metal, partially magnetized in combination with a reel or coil of wire, as above described, whereby and wherein the electric current so acts that the motions take place in a direction transverse to the axis of the coil, and parallel, or nearly so, to the planes in which the wire, constituting the coil, lies, and actuate suitable apparatus for giving such audible signals."

A bell or gong is substituted for the dial-plate and indicators, and the signals expressed by striking one, two, or more successive blows on the bell or gong, which is effected by wheelwork, for which no separate claim is made.

SIXTH CLAIM.

"We claim, as an improvement in electric telegraphs, the use of an apparatus for conducting the atmospheric electricity to the earth, in which the two semi-spheres of the lightning-conductor, as usually constructed for that purpose, may be adjusted to or from each other, as circumstances may require."

In lightning-conductors, as ordinarily constructed, there are two metal plates (say A, A′), which are fixed to and kept apart by blocks of ivory, and two semi-spheres (*c* and *c′*), which are made fast, one to each plate. The improvement here consists in making the semi-sphere *c* fast to the plate A (as usual), but attaching the other by a screw to the plate A′, "by which means, and by the aid of a regulating screw-nut, the semi-sphere of metal may be brought either closer or farther distant from the semi-sphere *c*, as may be rendered necessary by the expansion or contraction of the instrument, or other circumstances."

Digitized by Google

SEVENTH CLAIM.

"We claim, as an improvement in electric telegraphs, the insulator, and stretching of the long circuit wires upon and by means of an insulator, bell-shaped in the interior, so as to prevent the rain establishing a circuit for the electricity from the wire to the support upon which the insulator is affixed, and so shaped on the exterior as to admit of a stretcher, constructed as described, being applied at pleasure, to stretch the long circuit wires from insulator to insulator."

These insulators are to be made of glass, earthenware, porcelain, or metal.

EIGHTH CLAIM.

"We claim, as an improvement in electric telegraphs, a deflector, constructed and arranged as described, in combination with an earth-plate to each instrument, whereby the electric current may be diverted, and the instruments insulated in such manner as to allow the instruments at two or more stations on a long line to communicate with each other, independently of the other stations."

NINTH CLAIM.

"We claim, as an improvement in electric telegraphs, the use of the apparatus called "the hydraulic battery," in which the acid to the sand, or other retainer of moisture, is supplied from above, drop by drop, and escapes from below, drop by drop, so as thereby to keep up continuously a percolation through the sand, or other retainer of moisture, and, by such percolation, carry off the sulphate of zinc, and prevent its becoming crystallized on the plate; and we claim the said hydraulic battery, both as an improvement in the working of electric telegraphs, and as applicable to the working of time-keepers or clocks, where electricity is employed as a motive power, and for other purposes in which a steady uniform current of galvanic electricity is required."

Of this battery we have already published a description, vol. xlvii., p. 523.

TENTH CLAIM.

"We claim for time-keepers, in which electricity is a moving power, the use of a ring or piece of metal, partially magnetized, in combination with a reel or coil of wire, as above described, whereby and wherein the electric current so acts that the motions take place in a direction transverse to the axis of the coil, and parallel, or nearly so, to the planes in which the wire, constituting the coil, lies, and are adapted to suitable apparatus for measuring and indicating time."

As electric time-keepers require but a small power for keeping their pendulums in motion, "a sufficient current may be obtained from two series of any one kind of metal, (for which purpose zinc or iron is the most economical,) buried in the earth;" and "when zinc is used for the series, the supply of electricity may be augmented by surrounding one set of the plates of the series so employed with a solution of ammonia."

Of the precise meaning to be affixed to the term "partially magnetized ring," used throughout this specification, no explanation is anywhere given.

THE BREAK OF GAUGE QUESTION.

Mr. R. Stephenson has published this week a well-timed pamphlet on this subject, which deserves and will command universal attention.* All the world is aware that, through the meretricious striving after novelty, for the mere novelty's sake, of a very clever, but most pertinacious and somewhat unscrupulous gentleman, the right (or *Western*) limb of our vast railway system has been thrown sadly out of joint; and many may be aware also, that Mr. Brunel has proposed to mend the broken joint by a mixed system of broad and narrow gauges. The object of Mr. Stephenson's present "Observations" is, to show that the remedy is even worse than the disease. He does this with a degree of ability, and with an amount of practical knowledge brought in aid of it, which is absolutely overwhelming. Not all the *seven* champions of Christendom could help Mr. Brunel out of the abyss into which his *seven* feet folly has plunged him.

* The Double Gauge. Observations by Mr. Robt. Stephenson on Mr. Brunel's Report on the Double Gauge. Stewart and Murray. 28 pp. 4to, with numerous plates.

Digitized by Google

We once thought that the break of gauge might be remedied by some such plan as that of Mr. Henson, noticed in a recent No. of our journal; but we now see that there are objections to it, which neither that nor any other plan can obviate. We allude more particularly to the *break in the buffers*, which is a necessary consequence of the *break in the gauge:*

"Common sidings for both gauges could only be used alternately for vehicles of the one gauge or the other, not for both at one time; but if once such sidings were laid down, there could be no security against their being used for both kinds of stock at the same time: it is therefore necessary clearly to point out the danger which would arise from such a practice.

"This danger will be readily appreciated by any one who has stood by and observed a carriage at a station come into contact with another, while a porter stands perfectly secure between the buffers, the carriage bodies being prevented by the projection of the buffers from approaching so close as to crush him.

"By reference to drawing (No. 10), it will be seen that the carriages of the ordinary construction, narrow and broad gauge, when standing together on a common three-rail siding, will not buff together, the buffers missing each other, and coming in contact instead with the opposite carriage-frames. It is unreasonable to expect that a porter shall always, in the hurry of business, be able to consider whether an approaching carriage is narrow or broad gauge, and, consequently, whether he is safe or not if engaged in the siding: at any rate, no such danger should be thrust upon him by defective arrangements. To render a three-rail common siding safe, it would then be necessary to alter the buffers of the entire stock of the whole connected system of railways, using such siding in such way, that the narrow and broad carriages should buff together; for when once a number of railways are connected into one system, the stock finds its way to every part of the system at one time or other; indeed, it is the very object of the proposed mixture of gauges, that goods and passengers may proceed to their destination without change of vehicles; narrow or broad gauge vehicles must be everywhere in turn, as the traffic demands; and, until all of them are made to buff indiscriminately together, there can be no safety for porters in a three-rail siding. Accidents of this nature occurred from the use of stock not buffing together on the Glasgow and Greenock Railway until the remedy was applied: within a short period, several persons were injured, some fatally.

"Besides the danger to the men, it is clear that the buffers of every carriage (whenever two of different gauges come together) striking the cross framing of the other carriage, instead of the longitudinal framing or buffer ends, would knock the carriages to pieces; one or two blows of this nature, indeed, would, in all probability, so shake the framing of a carriage as to make it unsafe."

We should be disposed to compassionate Mr. Brunel under the severe infliction of this pamphlet, could we dismiss from our recollection the exceeding presumption and conceit which are at the bottom of his deviation from the standard system, and the enormous expense which it has entailed on his too confiding employers and on the public at large. We have been told by a friend of Mr. Brunel's, that he was first induced to think of the 7 feet gauge from the ease which he felt in riding in the state coach of a petty German potentate, which was some seven feet between the wheels! Lucky for the nation that the distance was not seventeen! We rather incline, however, to another authority, according to which, the Great Western Railway was made of the seven feet gauge because it was originally intended that its metropolitan terminus should be the "Seven Dials!" And taking that view of the case, we cannot help recognizing another marvellous turn of good luck in regard to this gauge affair; for had Mr. Brunel only been the engineer of the South Western, instead of the Great Western Railway, we should, to a certainty, have had a *nine* feet gauge, because it would have led to a "*Nine*-Elms" terminus!

Seven or *nine*, no better reason can be assigned for the one number than the other; and though many considerations, and good ones, too, have been suggested for a little exceeding the 4 feet 8½ inches standard (which, by the way, is just as empirical as any other, and has nothing but use and wont in its favour), in order to give more boiler and engine room, there has, to this hour, been no reason worth a jot, offered for selecting 7 feet as the only proper width, any more than 5, or 5½, or 6, or 6½, or 7, or 7½, or 8, or any other conceivable number.

Digitized by Google

PORTABLE CANNON.

The American papers make mention of a new sort of cannon, invented by a Mr. Fitzgerald, which is so constructed that it may be carried by hand or on horseback over mountains, forests, or marshes, where an ordinary cannon would be altogether useless. It consists of a series of circular perforated plates of the best wrought iron, 1-4 to 1-2 inch thick, with well planished faces, which are arranged in contact, and are connected together by wrought iron rods or bolts, passing through holes near the periphery; the bolts having strong heads at one end, and a screw nut at the other, whereby the plates are firmly held together. Several of the plates at the breach are, of course, solid, and without the hole in the centre. The series being thus connected, they are bored and polished inside, and turned off to the proper shape outside. While this cannon is stronger than those of common cast iron, it can readily be dissected, and each section may be shouldered by either pedestrian or equestrian artillerists, and when required, the parts may be put together and secured ready for action in ten minutes.

ELECTRIC CHRONOMETERS.

Electric Telegraphic Company,
Clock Department,
142, Strand, London, and
11, Hanover-street, Edinburgh.
August 19, 1847.

Sir,—Observing in your Journal of Saturday, August 14, a letter signed "Mechanicus" upon the subject of electric chronometers, I beg to inform the writer that this company have for some time been engaged in experiments to accomplish this object, and with every appearance of success.

A chronometer upon this principle, which will never require winding up, would be most invaluable, and by taking the electric current from the sea, which is easily done, a power would be obtained which we have reason to believe can be adjusted with the greatest nicety.

The fact of a vessel not being always at sea is of no moment, for the mere moisture from the sand or mud upon which she must necessarily rest, if not quite afloat, would be sufficient to keep up the electro-magnetic action.

The problem, however, will shortly be solved by a trial, the only true method of proving the theory; in the meantime, Mr. Editor, should you, your correspondent, or friends, feel disposed to pay a visit to the Company's office, No. 142, Strand, I shall be happy to show you a great variety of electric clocks, most accurate time-keepers, and explain the principle upon which they are constructed.

I am, Sir, yours, &c.
JOHN KYMER, Jun.,
Secretary.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 166.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

John Crang Hancock, of Wych-street, in the parish of St. Clement Danes, (Middlesex), organ builder: of an invention of a new grand pianoforte, with spring key touch, German flute and harp. Cl. R., 30 Geo. 3, p. 4, No. 7. April 13, 30 Geo. 3; May 10, 30 Geo. 3, 1790.

James Rumsey, of St. Margaret (Middlesex), engineer: of "new and improved certain methods of applying the power of water, of air, and of steam, either separately or together, as circumstances may require, to the purposes of milling and giving useful motion or effects to various kinds of machines, and for the advantageous management of shipping and vessels of all descriptions used in and upon water of all kinds in various circumstances and situations." (Several of the machines or engines in this specification are improvements on others of the same nature invented by the specifier, for which a patent was obtained 6th Nov. 1788, and the specification thereof was enrolled 6th Dec. in the same year.) Cl. R., 30 Geo. 3, p. 4, No. 3. March 24, 30 Geo. 3; May 22, 30 Geo. 3, 1790.

Estienne Leguin, of New Compton-street, of St. Giles-in-the-Fields, optician: of an invention of making certain machines or instruments which will not only save much time and trouble in calculating the Longitude, but be less liable to err than any of the methods now in use. Cl. R., 30 Geo. 3, p. 4, No. 1. June 1, 30 Geo. 3; June 30, 1790.

William Roberts, of High-street, Bristol, linen draper, and *William Dight*, of the same place, painter: of an invention, art, or mystery of running or laying paint mixed and prepared, with oil and other materials, commonly called Oil Colours, one upon another in thin layers upon canvas, wood, iron, stone, or any substance of that kind, in a way not as yet known in practice [and in such a way as to preserve their transparency].

Digitized by Google

Cl. R., 30 Geo. 3, p. 5, No. 13. May 11, 30 Geo. 3; May 29, 1790.

Roger Wearn, of Phillack, Cornwall, bricklayer: of a certain new invented method of heating the boilers of steam engines with a smaller quantity of fuel than is now used for that purpose, and also by the fire used in such boilers to calcine ores at the same time. Cl. R., 30 Geo. 3, p. 5, No. 1. July 8, 30 Geo. 3; July 27, 1790.

Robert Barclay, of Southwark, brewer: of a method of making punches for stamping and punching the matrices of printing types for letters and devices, and for impressing on copper cuts or other printing plates, and on dies, and on various metals, and on any other substances, certain marks; which letters, devices, and marks cannot be counterfeited. Cl. R., 30 Geo. 3, p. 6, No. 7. July 26, last past, 30 Geo. 3; Aug. 17, 30 Geo. 3, 1790.

Charles Earl Stanhope: of an improved method of moving ships and vessels against wind, waves, current, or tide, or against the power of them all united. Cl. R., 30 Geo. 3, p. 7, No. 2. Aug. 17, 30 Geo. 3; Nov. 1, 1790.

Johanna Hempel, of King's-road, Chelsea, potter: of an invention of a certain composition made of earth and other materials, and the means of manufacturing the same into basons and other vessels, which so manufactured hath the power of filtering water and other liquids in a more cheap, easy, and convenient manner than water or other liquids can now be filtered. Cl. R., 30 Geo. 3, p. 8, No. 8. Oct. 16, 30 Geo. 3; Nov. 13, 1790.

George Singleton, of Featherstone-street, Middlesex, calico glazier: of certain alterations, improvements, and additions in, about, and to the old machine for glazing of linens, cottons, calicoes, muslins, stuffs of linen, and cotton buckrams, and various other articles of British manufacture, as well as those of India. Cl. R., 30 Geo. 3, p. 8, No. 3. Nov. 6, last past; Dec. 4, 1790.

Thomas Nightingale, of Milk-street, London, calenderer: of a machine for calendering, glazing, and dressing of muslin, calico, cotton, linen, woollen, silks, paper, gauze, mohair, and other articles, in a superior manner to any which have heretofore been used or discovered. Cl. R., 30 Geo. 3, p. 8, No. 1. Nov. 16, 31 Geo. 3; Dec. 14, 31 Geo. 3, 1790.

Richard Law, of Birmingham, plater: of an improved method of making shoe-buckles and chapes. Cl. R., 30 Geo. 3, p. 11, No. 18. Jan. 23, 30 Geo. 3; Feb. 17, 30 Geo. 3, 1790.

Samuel Hands, of Birmingham, buckle-maker: of a new invented method of ornamenting all kinds of buckles, straps, coaches, chaises, phaetons, harness, and accoutrements of leather or paper used by man or horse (with gold, silver, and all other metals, glass, pearl, ivory, and other substance whatever). Cl. R., 30 Geo. 3, p. 11, No. 11. Feb. 23, 30 Geo. 3; March 19, 1790.

William Morecroft, of Litchfield, architect: of an invention of a new mechanical crane or machine for the purpose of lifting and shifting of weights of different descriptions or kinds. Cl. R., 30 Geo. 3; p. 13, No. 1. July 8, 30 Geo. 3; Aug. 3, 1790.

Matthew Boulton, of Soho, Stafford, engineer: of certain new methods of applying the powers of water mills, cattle mills, and steam-engines, either simply or combined, with the pressure of the atmosphere, and with weights and springs to the working of fly presses, or stamps, such as are commonly used for the purpose of sticking or making impressions upon buttons, buckles, or other pieces of metal, as well upon steel dies, or medals, or coins, and also to the working of presses for cutting out blanks for any of the above purposes. Cl. R., 30 Geo. 3; p. 14, No. 2. July 8, 30 Geo. 3; Aug. 5, 1790.

(To be continued.)

NOTES AND NOTICES.

A Wire Suspension Bridge is now erecting over the Ohio, which will be the largest structure of the kind in the world, having a span of upwards of 1,000 feet, whereas, that of Fribourg is but of 800 feet.

Natural Compass.—In the vast prairies of Texas, a little plant is always to be found, which under every circumstance of climate or change of weather, invariably turns its leaves and flowers to the North.

The highest fountain in the world is in the grounds of the Duke of Devonshire, where a single jet is thrown up to a height of 267 feet—more than 100 feet higher than Niagara Falls.

A Large Raft.—A raft, from Canada, *nine hundred feet* in length, 39 feet in width, and drawing 3 feet water, was towed into Buffalo. The raft was composed of spars and pine saw logs, upon which was 170,000 feet of sawed pine lumber.

New Cluster of Stars.—The *Cincinnatti Herald* of July 10, states that Professor Mitchell has discovered a new cluster of stars, one thousand in number, to which he has given the name of "Beecholde." Their appearance is singular. They are of a blue tinge, and emit an unsteady light. They seem to revolve in a spiral orbit

Daguerreotyping Lightning.—The *St. Louis Revelle* says that an artist in that city has, after repeated experiments, actually succeeded in Daguerreotyping a *streak of Lightning*. "So perfect and instantaneous was the operation that myriads of intervening drops of rain were transferred with wonderful distinctness to the plate, every drop retaining its globular form, showing that no appreciable space of time was consumed in the operation."

Baby Jumpers!—The Philadelphians are in a high state of excitement, respecting certain newly-invented articles thus named. They describe one as follows: "Imagine a cord fastened to the ceiling, and thence diverging into several cords, which are fastened to a child's frock by attachments to the belt. The chord

Digitized by Google

a elastic, and the child being attached to it, may be left to itself and will find its own amusement in the constant jumping up and down and about, which its movements occasion.

Messrs. Sibley and Rutherford's Earthwork Tables.—We find that we were in error in supposing Mr. Rutherford's colleague in the production of these tables to be Mr. Sibley of Great Ormond-street, the member of the Council of Civil Engineers. Our error, however, consisted but in the substitution of father for son; the real author being Mr. Charles Sibley, who was educated and took high honours at Addiscombe, went afterwards to India, returned to England on account of his health, and is now one of the resident engineers of the Sheffield and Lincolnshire Railway. We knew of Mr. C. Sibley's departure for India, but had not heard of his return to England, and hence our mistake.

WEEKLY LIST OF NEW ENGLISH PATENTS.

[No patents sealed between August 14, and August 21.]

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Aug. 13	1165	Joseph Salt	Uxbridge	An improved expanding die for making articles moulded in clay.
14	1166	John Talbot Ashenhurst	Upper John-street Fitzroy-square	Improved folding and reading desk.
17	1167	S. Mordan and Co.	City-road	Spiral spring inkstand top.
18	1168	Richard Fred. Bickerton	Castle-street, Southwark	Ventilator for hats, &c.

Advertisements.

TO MINE AND COLLIERY PROPRIETORS, SLATE QUARRY OWNERS, RAILWAY CONTRACTORS, IRONMONGERS, DEALERS IN GUNPOWDER, AND OTHERS.

MESSRS. JOHN HALL AND SON, THE PATENTEES AND SOLE MANUFACTURERS OF

SCHONBEIN'S PATENT GUN-COTTON,

Respectfully state, that they are now prepared to SUPPLY the PATENT GUN-COTTON (compressed for the convenience of carriage), in round and square paper cases, of 4 ozs. each, packed in boxes, containing 50 and 100 cases each, at the price of 3s. per lb., for ready money.

Also, in tubes or cartridges of... 1, 1½, 1¾, and 1¾ inch diameter;
Containing ..... 2, 4, 6, and 8 ounces each, at the
Additional charge of..... 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 3 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

Office, 23, *Lombard-street*, *London*.

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs T. Burnell and Co., 1, Great Winchester-street, London.

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings, and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Patent Bells.

MESSRS. MEARS beg to call the attention of the Trade and the Public generally to these articles, which they are now prepared to supply in any quantity and variety. The composition is of a new metal, called the Union Metal, and the bells are of very beautiful tone, and cheaper than those made of the ordinary bell metal. Orders received at the Bell Foundry, Whitechapel, for house, cattle, and other bells.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are, that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

CONTENTS OF THIS NUMBER.

Description of Craddock's High-Pressure, Expansive, and Condensing Marine Engine—(*with engravings*) 170
On Yacht Sailing. By Commander Shuldham, R.N. 175
"Can a Balloon Ascend in Vacuo?"—Mr. MacGregor in Explanation 176
The Britannia Tunnel Bridge over the Menai Straits.—General Pasley's Letter and Mr. Stephenson's Reply 176
Description of Ditto 179
Timber Mining in America 179
Singular Magnetic Attraction of Mud 180
Mallet's Patent Axle Bearings—(*with engravings*) 180
Collectanea Electro-Telegraphica 183
Messrs. Brett and Little's Electric Telegraph—Abstract of Specification 185
Mr. R. Stephenson's "Observations" on the Double Gauge—(Review) 187
Fitzgerald's Portable Cannon 189
On Electric Chronometers. By John Kymer, Jun., Esq. 189
Calendar of Specifications—(*continued*) 189
Notes and Notices 190
Weekly List of Articles of Utility Registered. 191
Advertisements 191

NOTICES TO CORRESPONDENTS.

J. E.—Received and under consideration. The further paper offered would be acceptable.

G. E. D.—No "appropriate covers" are printed; otherwise they should have been cheerfully supplied.

Communications received from Vulcan—Mr. G. Bell—Mr. Ranwell—W. R. S.—Utilitas—N. P.—Mr. Currie.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1255.] SATURDAY, AUGUST 28. [Price 3d.

Edited by J. C. Robertson, 166 Fleet-street.

WRIGG'S PATENT SELF-CARRYING RAILWAY CARRIAGE, FOR COMMON ROADS, FIELDS, &c.

Fig. 1.

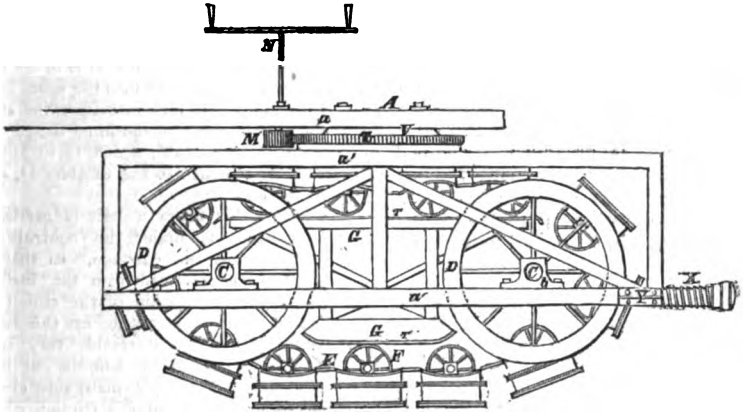


Fig. 1*.

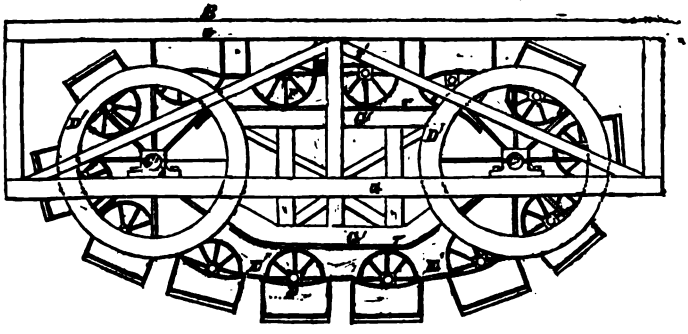
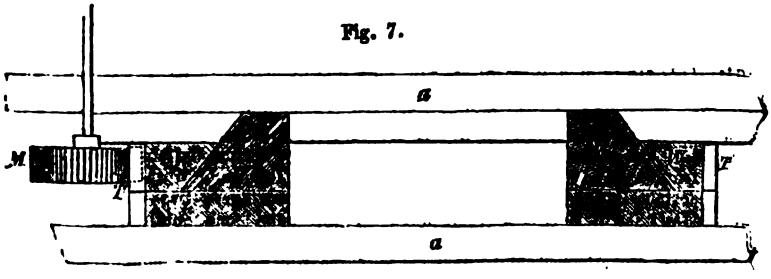


Fig. 7.



Digitized by Google

WRIGG'S PATENT SELF-CARRYING RAILWAY CARRIAGE, FOR COMMON ROADS, FIELDS, ETC.

MR. WRIGG describes his invention as consisting generally in diminishing draught and friction in carriages and other conveyances, by constructing every description of carriage in such manner, and providing it with such appendages and appliances that its weight shall always be borne by rails attached to the carriage, and *resting or moving on one or more of an endless chain of friction wheels* caused to revolve by the traction or propulsion of the carriage in a longitudinal direction; and this, whether such carriage move on prepared or unprepared ground, and whether it is propelled by animal or steam, or any other power. Several other plans having the same object in view have been at different times proposed, but Mr. Wrigg's differs from them all (according to the best of our recollection) in this essential particular—that his carriage by its revolution lays down an endless series of friction rollers, and then upon these rollers an endless series of rails, which last support the weight of the carriage, whilst in the other plans to which we have referred, the rails bear directly on the ground.

Fig. 1 and fig. 1^a of the accompanying engravings represents a side elevation of a carriage, constructed, according to Mr. Wrigg's plan, to be propelled by steam—Figure 1^a being supposed to be a continuation longitudinally of figure 1. Fig. 2 is a plan. (In both figures some of the less material parts are for the sake of greater clearness omitted.)

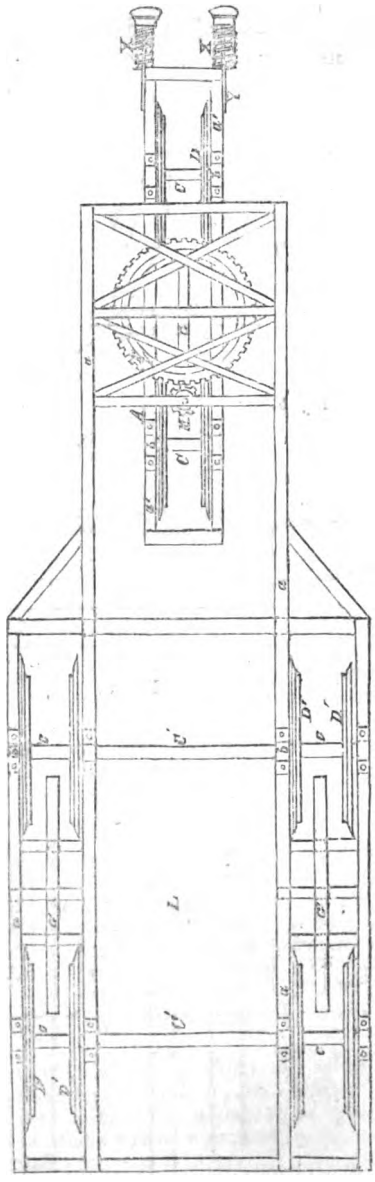
The carriage consists of two distinct bodies, A and B, connected by one common frame work *a a*; the front body A serving to guide the carriage, and the hind body to carry the passengers or goods as also the steam machinery by which the whole is to be propelled. Each body is provided with its own separate rails and friction-wheels. The machinery peculiar to the front body A, is sustained by a separate framework a^1 a^1. C C are solid cranked axles, which revolve in brasses *b b*, and D D are deeply flanged tumblers made fast to hollow axles which encircle the solid axles C C. E E are links of the endless chain, or series of railway friction-wheels F F, which, with their pedestals P P, revolve round the tumblers D D; and G G is a frame fixed between the tumblers to which the stationary rails *r r*, are attached, and which may be either flanged or plain. A side elevation of one of the axles C C, and transverse elevation of one of the tumblers D D, are given separately on an enlarged scale in figure 3. C is the cranked axle, and *c* the hollow axle which encircles it. D is the tumbler which is firmly attached to the hollow axle *c*; *d d* are the flanges; *f* is a clutch, by which the hollow axle *c* may be made fast to, or detached from the solid axle C at pleasure; *g g* are tappets attached to the tumblers in such positions, that as the tumbler revolves they catch into the links E E of the endless chain, which links fit into the space between the flanges *d d*, and rest upon the surfaces *e e*. On one side of the inner flange *d* there is a friction-drum *h*, which is in one piece with, or attached to the tumbler D, and revolves with it.

From this drum a belt is carried to a lever which is under the control of the conductor of the carriage, so that when the tumbler is freed from the main axle C, by the application of the clutch *f*, the conductor can, by acting on the belt and friction-drum as aforesaid, very speedily check the speed of the tumbler, or bring it to a state of rest. A plan, side elevation, and section of one of the friction-wheels F, with its pedestal P, and other appendages, are given separately on an enlarged scale in figures 4, 5, and 6. The pedestal P consists of an open square box of wood *k k*, (divided horizontally into two portions as presently explained) raised on a circular bottom *m*, which is also of wood, but is shod with iron, a layer of felt, *i i*, being interposed between the wood and iron to deaden the sound of the machinery when in motion. The axle *n*, of the friction-wheel F, turns in brass bearings *o o*, screwed to two of the sides of the box at top, and the wheel revolves partly within the box. The box *k* is divided horizontally into two portions as aforesaid, in order that the upper portion may in the course of the revolution of the wheels be turned round before the lower has deviated from a horizontal position; and this is effected by the intervention of the three metal pieces *p*, *q*, *s*. The first (*p*) is an annular plate of iron, which is made fast to the top of the under portion of the box, and projects considerably at the four sides. The second (*q*) is a similar annular plate of brass, but of less diameter, and consequently projecting less at the sides, which is made fast to the bottom of the upper portion of the box. These two plates move freely round upon one another, and are made, therefore, as smooth as may be on the surfaces which come in contact. The periphery of the plate *q* is bevilled outwards as

Digitized by Google

shown. The third piece *s*, is a ring of iron which rests on, and is secured to the plate *p*, and is bevilled inwards on the inside, so as to correspond with, and overlap the bevilled edge of the plate *q*. The result of this arrangement is, that as each pedestal comes to the turning point in the course of its revolution round the drums, the top part first moves very equably and steadily round, and then brings the lower part after it by means of the overlapping level edge of the ring *s*. The hinder body B of the carriage (see figures 1 and 2) is in most respects a counterpart in double of the front part A; that is to say, it has solid cranked-axles C′ C′, similar to C C, but of greater strength, and tumblers D′ D′, similar to the tumblers D D, but attached in pairs to the axles C′ C′, one at each end, and either fixed to, or turning loosely on these axles; two endless chains of friction wheels and pedestals F′ F′, and P′ P′, similar to F F, and P P (excepting only that the pedestals are not divided, but in one piece); and two fixed sets of rails G′ G′, similar to G G, which rest or move on the two series of friction-wheels F′ F′. The carriage is in effect a four-wheeled one, with two guide wheels (placed end to end) in front. The central space L may be appropriated to the accommodation of passengers or goods; or if the carriage is not designed to afford such accommodation, but to be employed in drawing or propelling passenger and goods vehicles, the space (L) may be occupied by the steam-engine, or other motive agent employed. M, N, T, V and W, are the parts of the machinery by which the two parts of the carriage A and B are made to move in unison. M is a pinion affixed to the underside of one of the cross pieces of the frame *a a*, which is common to both A and B, the axis of which pinion is prolonged upwards through the cross piece, and terminates in a hand lever N. T is a cog wheel affixed to the top of the framework *a′* of the fore part A into which the pinion M works. V is a circular ring bevilled outwards, which fits into a corresponding bevil edge W, raised on the top face of the cog wheel, and is made fast at top to the common frame *a a* (see sectional view of these parts, figure 7), whereby the two frames *a a* and *a′ a′*, and through them the two parts A and B of the carriage, are immovably connected together; while at the same time, the fore part A is left free to turn in any direction. X X are buffers, which act against spiral springs coiled round their respective shafts, which shafts play into sockets Y Y, attached to the sides of the frame. From the preceding description, the manner in which progression is given to the carriage will be readily understood. Previous to starting, some of the pedestals of each chain of friction-wheels are resting on the ground, while all the rest are wound round the tumblers; and the

Fig. 2.



entire weight of the carriage is sustained by such of the friction-wheels only as are in direct contact with the rails. It is desirable

Digitized by Google

in the case of the fore part A that there should not be more than one wheel in contact with the rails at a time, in order that this, which is the guiding part of the vehicle, may turn with as much ease as possible; and, with this view, the rails are made short, and rounded off at the end, as shown in fig. 1; but in the case of the hind part

Fig. 4.

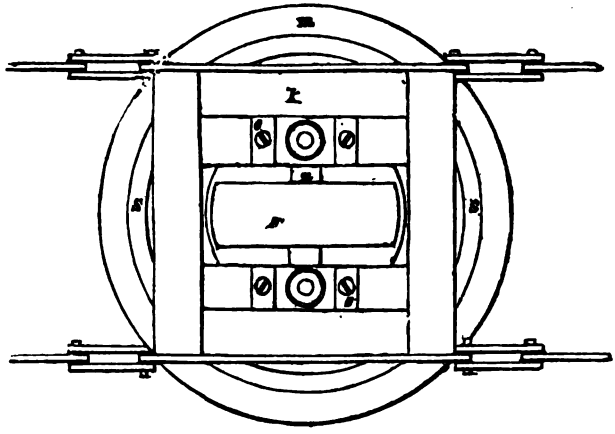


Fig. 5.

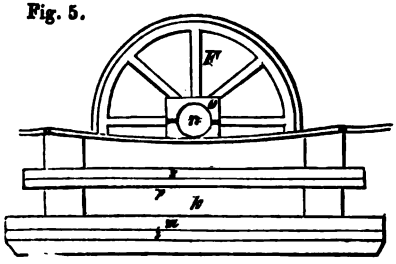


Fig. 3.

Fig. 6.

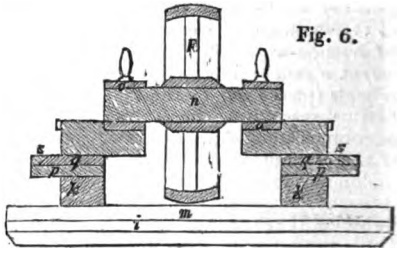
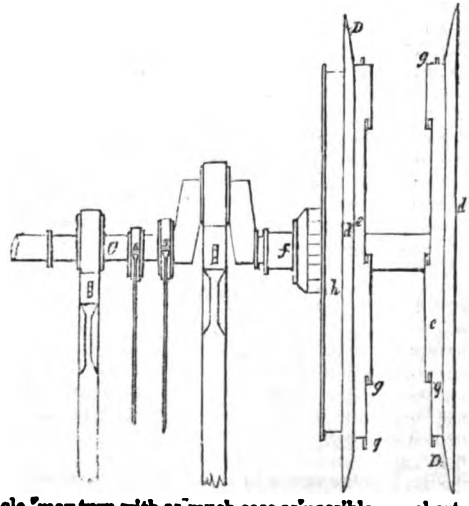
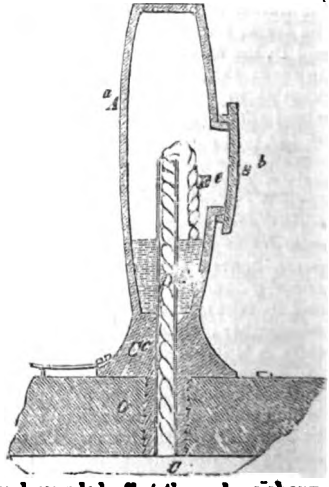


Fig. 8.





Digitized by Google

B, it is immaterial how many of the wheels may be in contact with the rails. When a rotary motion is given to the main axles C and C′ (by animate or inanimate power), and thereby to the tumblers D and D′, the carriage slides forward by means of the rails attached to it on the friction-wheels beneath; while, simultaneously therewith, a revolving motion is imparted to each of the endless chains of wheels, which brings one wheel after another in continual succession under the rails, producing thus all the effect of one continuous rail. The axles C and C′ of the tumblers D and D′ are represented in the drawings as turning in circular bearings; but where the carriage is intended to be used on very rough ground, it will be desirable to substitute slotted bearings, so that the tumblers may give way to a small extent upwards, and the carriage be thus more easily carried over any obstacle which it may encounter. Instead, also, of the pedestals being, as represented in the drawings, united by metal links, they may be united by pieces of leather, or other like flexible material; and, in either case, should the carriage be much exposed to dust or dirt, it may be proper to fill up the spaces between each pair of pedestals with a piece of leather or cloth, of the width of the pedestals, in order to catch such dust or dirt, and prevent its falling on the interior parts of the machinery on the pedestals becoming inverted.

When animal power is employed to draw the carriage, the fore or guiding part A may be dispensed with.

The oiling of the axles is effected by an oil-box of a peculiar construction, one such box being attached to the brass bearing of each axle. A sectional elevation of this box is given in fig. 8. A^a is the box, which is filled with oil to about the height shown. B^b is a lid, which is screwed on to a ring which projects from the side of the box. C^c, neck by which the box is screwed into the brass bearing o. D^d, a tube, which is passed down through the neck C^c to the axle C, and carried upwards a little way above the level of the oil in the box. E^e some threads of cotton, which, being inserted at one end into the tube D^d, and dipping at the other end into the oil, supply, by capillary attraction, a constant flow of the oil to the axle. F/, a circular rack, raised on the top of the brass bearing, and secured to the neck of the oil-cup, which takes into the rack F/, and holds the box fast when screwed into its place. The advantage of this oil-box is, that no supply of oil can be given to the axle except when the box is nearly vertical, and that there can be no escape of the oil except in the direction of the axle.

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

(Continued from page 34.)

Although it has been thought better to give an independent proof of the equation of vis viva, rather than found it on that of virtual velocities, the connection between the two is so great that one may be easily derived from the other.

The following is one way amongst others by which we may derive the equation of virtual velocities from that of vis viva.

It must be remembered that, in the equation

$$mv^2 + m'v'^2 + m''v''^2 + \&c. = 2\left(\int P dp + \int P' dp' + \int P'' dp'' + \&c.\right)$$

the velocities v, v', &c., are the velocities generated since the instant that the forces P, P′, P″, &c., began to act upon the system: care must be taken therefore with regard to the limits of integration on the second side, so that if at any given instant the velocities be (v_1), (v'_1), &c., and the corresponding forces P_1, P'_1, &c., and at another instant afterwards the corresponding quantities be (v_2), (v_2'), &c., P_2, P_2', &c., the equation will be

$$m(v_2^2 - v_1^2) + m'.(v'^2_2 - v'^2_1) + \&c. = 2\left(\int_{P_1}^{P_2} P dp + \int_{P_1'}^{P_2'} P' dp' + \&c.\right)$$

Suppose now any system of rigidly connected particles to be in motion, and that the first of the preceding equations expresses the relation between the velocities of the different points and the forces which have acted upon them up to that instant, at which the values of those forces are P, P′, &c. During the next instant the increment of velocity and force will be expressed by the relation,

$$m(.v.dv) + m'.(v'dv') + \&c. = P dp + P' dp' + \&c.,$$

Digitized by Google

where (dp) is the space described by the points of application of P in its own direction; and so of the rest.

Now suppose that at the beginning of the instant we are considering, the various acting forces are so related that from that moment the velocities (v), (v'), &c., become *uniform*: the motion of the whole system therefore at this instant is perfectly unaltered by the forces then acting on it: in other words, these forces are such that they mutually destroy each other's effect, and if the system were at rest, *would keep it at rest*. Hence at this instant we have, (since $dv=0$, $dv'=0$, &c., the velocities being at that instant uniform),

$$0=Pdp+P'dp'+\&c.$$

which is the equation of virtual velocities.

If at the instant we are considering the whole vis viva is a maximum or minimum (*i. e.*, as depending on the forces), in either case $dv=0$, $dv'=0$, &c., and the position at that moment is one in which the forces tend to keep the system at rest. "It is usual to distinguish between these cases as positions of stable or unstable equilibrium; but I suspect there is a fallacy in the reasoning, and, at any rate, we can only conclude anything for displacement of the system which *actually* occur in the motion itself: so that we are not authorized in supposing these to be the same as the ordinary *statical* positions of stable or unstable equilibrium. The question, however, is one of very little practical importance. It is also sometimes assumed that if the differential coefficient of the whole vis viva is zero, the vis viva itself is a maximum or minimum. With regard to this, Professor De Morgan has remarked, in his *Differential and Integral Calculus*, that 'The assumption that A is a maximum or minimum when $dA=o$, has occasioned many errors, and the greatest writers have their full share of them.'"

By the proof given in a preceding article, the equation of vis viva will be seen to be applicable to all motions of particles, during which the particles acting on one another *remain at the same distance*. It is therefore at once applicable to the motion of incompressible fluids, and indeed was taken as the basis of the first analytical Treatise on Hydrodynamics published — viz., that of Daniel Bernoulli.

His father, John Bernoulli—(one of the most quarelsome old men that ever lived, who was always squabbling with his brother James whilst he was alive, and with all and sundry afterwards) no sooner sees his son Daniel seizing hold and making use of this principle—(for which, as being his mathematical progeny, he entertained still more affection than for his less abstract offspring) than with a sort of feeling of "no poaching on my manor, if you please," he bethinks himself how he is to avenge the injury. It will be seen that the old gentleman was in somewhat of a quandary, for he could not deny the correctness of the principle, inasmuch as he himself had been its chief author and nourisher. And yet he was loath to admit that his son Daniel had made more of it than his father had managed to do. Still, to be outdone by Daniel would never do—so he sets him to work and writes a new treatise on the same subject, and in the preface does his best to make you understand that whatever was good and true in Dan's book, as depending on this vis viva ("*verissimo atque a me demonstrato*") must be set down to the credit of the father—but at the same time that Daniel's method being an indirect one, and moreover as neglecting to take into account a certain "gurges" or "whirlpool," which he, the father, had discovered (*ab aliis non animadversum*")—must altogether be a very inferior performance indeed to that with which he himself is about to favour you.

The old gentleman finds it easier however to get himself and his readers into this newly-discovered whirlpool, than out of it again.

With regard to the motions of elastic media, the question as to the applicability of the equation of vis viva is more intricate, and at the same time of considerable importance. In all cases where two vibrating particles of the medium, contiguous to one another, undergo precisely the same motions, and at the end of any given time return to their original distance, the equation evidently holds good, as the proof given above shows. For the action between them is equal and opposite, and by supposition, the spaces through which it acts are the same for the two particles.

Digitized by Google

But if we have, as in the undulating theory of light, to investigate what takes place at the confines of two different media, although we are certain that the mutual force is the same for both, we are by no means sure that the spaces through which that force acts are the same for both; and, moreover, the forces acting on the particle in the denser medium, are not the same as those on the particle in the rarer medium; so that, although they return to their original distance, one may have gone over a much greater space than the other. This is a question, however, which as yet has never been thoroughly examined.

The history of this vis viva is altogether curious. For a history of the dispute connected with it, which lasted about sixty years, and set almost everybody in Europe scribbling about it, the reader may refer to *Whewell's Hist. Inductive Sciences*, vol. ii. Leibnitz commenced it by a paper in the *Acta Eruditorum*—"A short demonstration of a memorable error of Descartes and others concerning the natural law, by which they think that God always preserves the same quantity of motion; in which they pervert mechanics." The strange way in which the mathematicians of those days thought good to reason, or rather to write about the matter, is often not a little amusing. Even the best of them talk very queerly: for instance, John Bernoulli has a paper, *De Vera Notione Virium Vivarum*, in which he says, "Vis viva does not consist in *actual exertion*, but in the *faculty or power of acting*; for it exists, even though it do not act, and has nothing to act upon." "Hence it appears," says he, in another place, "that this vis viva is something *real and substantial*, which subsists per se, and, as far as in it lies, is not dependent upon any body"—"quantum in se est non dependet ab alio." It would, therefore, appear to be a substantial, independent gentleman, "living on its means"—none of your flimsy mathematical abstractions. As I have said, everybody had a hand in the dispute—a French marchioness amongst the rest, in a learned "Treatise on Fire." Voltaire, too, above all earthly men, must needs read a *Memoire* on the subject to the Academy. Now, what was all this dispute *about?* Why, if there *really* was any *real* dispute at all (which is rather doubtful, and always is in such cases), the point in question was this:—Whether the magnitude of a force should be *measured* by the velocity generated (in a given mass) in *a certain time*, or by the velocity generated in moving through *a certain space*. If in the time (t) a force produced in a mass (m) a velocity (v), then Newton had taken as the *measure* of that force the product mv; and those who considered themselves his partizans and defenders in the dispute alluded to, contended that this was the *only proper measure*. Leibnitz and his followers would have it that the only proper measure was the product mv^2, where (v) is the velocity produced or destroyed in moving through a given space (s). This they confirmed by citing the following experiments:—Balls projected horizontally against a wall of clay, or other resisting substance, penetrated to depths proportional to the squares of their velocities (the masses being the same). Also, bodies projected upwards, rise to heights proportional to the square of the velocity of projection. Now, the whole question is very easily decided by referring to those simple and self-evident principles by which we are necessarily guided in *estimating* or *measuring* any cause by certain of its effects. In comparing, therefore, one force with another, we are at perfect liberty to take *any* of the effects (as, for instance, the velocity produced), *provided all the rest of the circumstances are the same* in the two cases. The velocities produced, for example, will be correct measures of the force, provided they be produced in *equal times* in *equal masses*, all the other concommitant circumstances being also the same. Now, in the case of the balls fired upwards, or into the clay wall, this necessary condition of equality of circumstances was overlooked by most of the Leibnitsians, inasmuch as the ball which rose highest in the air, or sunk deepest in the clay, would take a *longer time* than the other. The one, for instance, being fired with a velocity (v), and penetrating a space (s), and the other with a velocity (v'), and penetrating a space (s'), if we denote by (f) the resisting force of the clay, or the retarding force of gravity, we have

$$v^2=2fs, \quad v'^2=2fs'. \quad v=ft \quad v'=ft'.$$

(t) and (t') being the times of motion in the two cases. Hence it is seen that, if the *space penetrated* be alone considered, and taken as the *measure* of the

Digitized by Google

force, then the square of the velocity is proportional to that quantity; but if, as we evidently ought to do, the *time* be also taken into account, then, measuring the force by the space described, directly, and the time employed, inversely

$$\frac{s}{t} = \frac{v}{2}, \quad \frac{s^1}{t^1} = \frac{v^1}{2}.$$

I have said "some of the Leibnitzians" seem to have forgotten this necessary precaution; but John Bernoulli was perfectly aware of it, only he contended that any force ought to be measured by the *whole* effect produced, without any reference to the circumstances under which it was produced, and uses the queer illustration that, in estimating the quantity of water in a basin, we never think of how long it would take to fill it. The answer is easy. Though, in *measuring any one force without reference to, or comparison with any other*, we may properly take the whole effect so produced; yet, in comparing with others, we must have all the circumstances the same: and, to use his illustration, though, in measuring the work done by a person in filling the basin with water, we might take the quantity of water put in as a measure, if we had to compare this with the work done by another person in filling another basin, we must take into account *how long* each person took to do it. Or, to use another illustration, a man might carry a ball of iron as far as a cannon could fire it; and so we might say the *whole effect* of the two was the same, or the whole force expended in each case the same: yet, obviously, for all ordinary purposes of comparison, we must consider not only the work done, but *the time in which* it is done,—not only the whole effect produced, but the time in which it is produced.

There has been a curious sort of "metempsychosis," or transmigration of ideas into different forms, in this subject, from "work done" to "vis viva," and from "vis viva" to "work done."

Lagrange, in his *Mecanique Analytique*, states that Descartes "reduced the whole of statics to the principle, that it requires neither more nor less force to raise a weight to a certain height, than would be necessary to raise a greater weight to a height proportionably less, or a less weight to a height proportionably greater. Whence it results that there will be equilibrium between two weights when they are so connected that the perpendicular paths which they can simultaneously describe are reciprocally proportional to the weights. But, in the application of this principle to different machines, we must consider only the spaces described in the first instant of motion, and which are proportional to the virtual velocities."—(tome i. p. 21.)

Here then we have the simple and natural idea of "work done," changed into the principle of virtual velocities; which, again, has been made the foundation of that of vis viva, from which, again, in the last place, the original notion of "work done" has been elicited in a form adapted to the calculation of the effects of machinery.

With those modifications which the change of conditions would require, I think it probable that in this equation would be found the best method of calculating the relative efficiency of the paddle and screw—as by it a relation might be got between the quantities of water put in motion *uselessly* in the two cases.

A. H.

(To be continued.)

BROWN'S DISINFECTING PROCESSES AND ARTIFICIAL MANURES.

[Patent dated 20th February, 1847. Specification enrolled 20th August, 1847.]

The present invention which is stated to have been communicated to the patentee from abroad, consists, firstly, in neutralizing the odorous and noxious gases emanating from fecal substances, or, as it is sometimes termed, the "disinfecting" of such substances, whereby they may be collected and preserved, in order to their being manufactured into carbonic compounds applicable as manures, without injury to the public health, or to the individuals engaged in such collection and manufacture; secondly, in converting the said fecal substances into carbonic compounds applicable as manures; and, thirdly, in manufacturing carbonic compounds from the muscular flesh, blood, and offal of dead animals, and from the ammoniacal waste matters of various manufactories.

We extract the following details of the invention, from the specification:

The substances employed for the purpose of disinfecting are, either the sulphate of iron or the chlorides of sodium (sea-salt), or the chlorides of iron and manganese; or

Digitized by Google

the nitrates, sulphates, and chlorides of lead, copper, zinc, and tin; or pyroligneous acid; or the pyrolignites of iron; or the mother-waters arising from the manufacture of any of the before-enumerated substances; or coal-tar; or schistous and bituminous extracts. Of these, preference is given to the sulphates and chlorides of iron. All of them must be used in a dilute state. When solutions of sulphate of iron or chloride of iron are employed, they should be poured into the cesspool, or other fecal receptacle in the proportions of from one to two and a half gallons of the former, and from one to one and a half gallons of the latter for every 48 inches of the cubical contents of the cesspool, or other receptacle. The mass should then be stirred, in order to effect a combination of the salts with the matters to be disinfected, after which some of the absorbent powder hereinafter described should be thrown in over the whole. The cesspool or other receptacle must then be closed for about ten minutes, when the removal of the night-soil may be commenced, without fear of any unpleasant smell. The emptying of the cesspool, or other receptacle may be effected either by means of an exhausting pump and hose (the matter being supposed to be in a sufficiently liquid state), or by means of an endless chain of pails or buckets, enclosed in a case or hood, to conceal the operation from view. As the matter is taken out, it is turned over into casks, which, on being filled, are closed up, and then removed to the (manure) manufactory.

An absorbent powder is then formed by mixing about 75 parts of coal or wood ashes and earth, or street or road sweepings, and about 25 parts of vegetable, animal, or mineral rubbish, such as saw-dust, bone-dust, &c. These matters are incinerated to powder by subjecting them, in closed vessels, to a high degree of heat, so that the carbon contained in the organic portions of the mixture may be blended, in a state of extreme division, with the earthy portions, and impart thereby to the whole a highly absorbent property. Three different sorts of ovens or stoves are employed to effect this incineration. The *first* consists of a brick or cast-iron floor, covered over by an arched roof, and set in brickwork, in such manner that the flame and heated vapours of the furnace may wind all round it. In the roof there is a door for introducing the materials, and at the bottom, on a level with the floor, there is another, for withdrawing them. The oven being filled, and the doors closed, it is heated to a dull red heat; and when the materials exhibit a very black appearance, they are withdrawn, and stored up in close vessels, in order that they may be preserved from contact with the humidity of the atmosphere. The *second* oven is but a modification of the first, differing from it in this only, that the floor is made to slope slightly, and that the materials are introduced through one or more inclined passages made in the roof. The *third* consists of an iron cylinder set in brickwork, and enclosing a revolving vertical shaft, with radial blades, by which the materials are cut up and mixed. The top of the cylinder is closed by means of two sliding plates which take into recesses made in the brickwork, and have apertures in the centre just sufficient to allow the revolving vertical shaft to pass through. When the oven has been filled and heated, a rotary motion is given to the agitator, by hand, or any other suitable mover. The cylinder terminates at bottom in an inclined passage, through which the materials, when fully incinerated, are removed.

The inventor prefers to use an absorbent powder thus prepared; but he states, that there may be substituted for it either common (chimney) soot, or any of the black residual matters of sugar and other refineries, or the black deposits resulting from the combustion of resinous and bituminous substances.

When the fecal matters which have been treated and barrelled as aforesaid, arrive at the manufactory, they are immediately converted into carbonic compounds applicable as manures, by one or other of the following processes:

In the case of very small villages, or hamlets, where the amount of produce will not warrant the incurring of any considerable expense for machinery, or otherwise, the casks or barrels are emptied into the first of a series of three inclined pits or basins of an elongated oblong form, composed of brick pointed with mortar, so as to be perfectly water-tight, and placed terracewise one above another; that is to say, the first on a higher level than the second, and the second on a higher level than the third; the three pits communicating with one another, by means of self-acting floodgates. From the last of these pits any given quantity of the fecal matter is taken to what is called a "mixing basin," and there well mixed with from 15 to 20 per cent of the absorbent powder, prepared as aforesaid, or one or other of the substitutes for it before-mentioned, so that any adhering damp, or any gas which may be now disengaged, may be taken up or absorbed by the powder. The mixed materials are then taken from the "mixing basin" and spread out on platforms of baked earth, or on trays, to dry in the open air, and when fully dried they are again well pounded and packed up in casks ready for use. The

Digitized by Google

casks should be kept until removal in some close and dry place."

For cities, towns, and large villages, the following arrangements are adopted: The basins are each inclined as before, but they are made of a circular form, and placed on a line with one another, and from each basin there is a pipe for conducting any drainage or surplus liquid to a vaulted reservoir, common to the whole series, where it may be collected and applied to the manufacture of ammoniacal salts. Each basin is moreover furnished with an agitator, similar to that before described, worked by machinery, and it has at bottom a trap which opens into a passage constructed underneath the basin in the direction of its inclination. As the fecal matters, prepared as aforesaid, arrive at the manufactory, they are immediately thrown into these basins, and absorbent powder added in the proportion before directed. The agitators serve to mix the two matters intimately together, and as they are mixed they drop through the traps into the inclined passages underneath, from which they are removed in tilting carts to be dried as aforesaid. After drying, the carbonic compound thus formed is passed through a revolving cylinder composed either of perforated metal or metallic wire gauze, which is mounted in an inclined position, so that should there be any stones or other hard matters contained in the compound, they may roll to the bottom, and the finer portions only pass through the cylinder.

The mode of manufacturing carbonic compounds, applicable as manures, from the muscular flesh, blood, and offal of dead animals, and from the ammoniacal waste matters of various manufactories is as follows:

After the flesh has been skinned it is thrown into a copper filled with water, having a double or false bottom, which is piereed with holes. From eight to ten per cent. is added of sulphate of iron, chloride of iron, or any of the other salts or bases before named, or instead thereof, from 20 to 25 per cent. of common tan. The materials are then boiled until the flesh begins to be disintegrated, when the oil which has been formed is drawn off (from the space between the false and real bottom). The fleshy mass is then taken, out of the copper, and the bones separated from it; after which it is thrown into a hopper, from which it is passed between two grooved cylinders, to which a rotary movement is given by any suitable machinery. From these cylinders it comes away in the state of a thick jelly, which is either dried without any admixture, or after adding to it about 10 per cent. of the absorbent powder, which, without diminishing its strength, tends to retard considerably its decomposition. In some cases it will be sufficient to boil the flesh in pure water, and afterwards to immerse it for some time in any of the saline solutions aforesaid, or in cold tan liquor. When prepared by any of these modes the flesh dries without giving forth any repulsive smell, does not engender worms, and may be preserved for an unlimited time.

To preserve and convert into manure in like manner the blood and offal of slaughterhouses, much the same processes are followed as in the case of flesh. Either the fibrine and albumen of the blood are coagulated by boiling, or the materials are treated cold, mixed with some of the saline substances mentioned under the first head of this specification, and then about 25 per cent. of the absorbent powder added.

Excellent manures may also be obtained from the waste matters of various manufactories, which are rich in fertilizing principles, such, for example, as the waste from the manufactures of Prussian blue and prussiates, the ammoniacal waters of gas works, the waste of potash and soda works —in short, all remains or rubbish which abound in salts, or ammoniacal products. These waste matters are mixed with the absorbent powder, and used either alone or with the addition of a portion of the manure manufactured from animal remains.

MESSRS. DAVISON AND SYMINGTON'S PATENT DESICCATING PROCESSES.

We gave some account of these processes at the time when they were first patented (vol. xl., p. 338). We anticipated much good from them, and are pleased to learn that the public have not been slow in appreciating their merits. Already they have been successfully applied to not less than twelve different branches of trade,—brewing, distilling, bleaching, paper-making, feather-dressing, coffee-roasting, &c., and it would seem as if they must come ere long into universal use.

The reader may remember that the general principle on which these processes are founded is, the great desiccating property possessed by *rapid* currents of air of a high temperature. A simple enough matter of fact this, to note and apply; yet one which it is certain has been overlooked altogether, or at best but indifferently regarded in the multi-

Digitized by Google

tude of hot cockle, hot flue, hot water, and other "hot and all hot" plans which have of late years been obtruded on the public attention.

When we first noticed this system, we instanced its application to the seasoning of beer casks, as the most striking exemplification of its efficacy which then offered itself to our observation; but though we have been fully borne out in our views of the importance of that application, by the subsequent adoption of Messrs. Davison and Symington's plans in some of the largest breweries in the kingdom, this turns out to be, after all, but one of the least of the triumphs which the system has achieved. From the seasoning of casks, the patentees have gone on step by step, till they now undertake seasoning of wood and wooden articles of every description;* and give fair promise of benefitting largely not only every art and manufacture of which wood is an element, but the public at large. We have been obligingly permitted by them to inspect and make extracts from their "Dry Seasoning Book," and some of these extracts we subjoin as affording the best possible proofs of the advantages derivable from this desiccating system. They are records of work actually done—not by way of experiment merely, but in the ordinary course of an established and fast increasing trade. Each extract shows, first, the weight of the wood when sent in to be seasoned; next the daily diminution in weight produced by the desiccating process; and, lastly, the total quantity of moisture expelled—moisture which, if allowed to remain in the wood, could tend only to produce rot and decay. The extracts give also, in the case of planks, the degree of shrinkage in width produced. Some of the results are exceedingly startling. Mahogany is reduced in weight by desiccation 24·4 per cent., and pine planks 34·5. The woods least affected are fir and white deal, which lose 12·50 per cent. The degree of shrinkage produced is still more remarkable; amounting in both the cases noticed to not less than three-fourths. It will be observed, moreover, that all these effects are produced in the course of a few days—some ten or twelve at most; while by the ordinary mode of drying they could hardly be accomplished in as many months.

We need scarcely add that the less moisture there is left in wood, the greater its strength—the more complete its fitness for every purpose to which it can be applied.

Extracts from Seasoning Book.

Fir Joists, &c.

5 Pieces (only) Weighed.

	19th June.	23rd.	24th.	25th.
No. 1.	16 lbs.	14½	12	12
,, 2.	74	71	69	69
,, 3.	45	41	37	37
,, 4.	62	58	51	51
,, 5.	118	112	110	110
	315			279
	279			

Measurement. Width. Shrinkage.

	19th June.	25th.	
No. 1.	5½ × 2½	5	¼
,, 2.	9⅛ × 3½	8⅛	⅛
,, 3.	8¼ × 2½	7⅜	⅛
,, 4.	6½ × 2½	5⅞	⅛
,, 5.	9¼ × 2½	8⅜	⅛

Average shrinkage in width ⅛ full.

.36 lbs. loss, or 12.6 upwards of 12½ per cent.

Probable quantity of moisture removed from the 65 pieces 468 lbs. weight, or equal to 46 gallons water!

Average temperature of drying chamber, 120 degrees.

N.B. This wood was considered *seasoned* before it was sent to the Patent Desiccating Company's Works.

White Deal.

	July 12.								July 27.			
3 in. White deal	91 lbs.	89½	88	87½	86	85½	85	85	84½	84½	84	83¾	12½ per cent.
3 in. ditto.	64	63	62½	62	60¾	60½	60	60	59½	59½	58¾	58¾	12.2 per cent

Honbeam.

	July 12.											July 29.			
2½ Honbeam 5.0 long	76 lbs.	71½	71	70	68½	68	67½	66½	64½	64½	640	63¾	63	62¾	17.5 per lb.

* The works of the Company are those known by the name of the Grand Surrey Mills, adjoining the Commercial and East Country Docks, Rotherhithe; they have offices also at 28, New Broad-street, City.

Digitized by Google

Mahogany and Birch.

	July 2.											July 25.	
1½in. Mahogany. 11.0 × 18½	81	76	74½	71½	70½	69½	68½	68½	67½	67½	66½	65½	65½	19.6 per cent.
1 in. Ditto. 11.0 × 22½	66	61	58	55	54½	53	52	52	52	51½	50½	50½	50	24.4 per c. nearly.
1½ in. Ditto.	74½	71	69	66	66	64½	63½	63	62	62	60½	60½	59½	20 per cent.
1½ in. Birch.	84	77½	73½	68½	68	68	68							

Owner's own weighing.

1½ in. Birch.....	95	1 in. Mahogany	73
After seasoning...	63	after seasoning	60
	32		13

Pine Plank.

	June 23.						July17.		
1½ Pine plank 22.0×2.2½	227	180	171	165	157	156	154½	153	152½	33 per cent.

18 days actual work; ⅛ shrinkage.

Pine Plank.

		July 31.	Aug. 2.							12th		
1 in. Pine plank	23.0×2.0	123	109	100½	95	92	89½	86½	84	82½	82	81	34.5 per cent. Still in chamber.
1½ in. Ditto.	11.0×2.2½	114½	103½	97½	94½	91½	89	86½	82	81½	81	79½	32.7 Ditto.
2 in. Ditto.	11.0×2.2½	138	129	124½	122	119	116½	114	110	109	108	106½	22.8 Ditto.
2½ in. Ditto.	18.0×2.2⅝	244	230	219½	213	207½	203½	198½	190	186	184	180	20 Ditto.

Spruce Deal.

	Aug. 2.					7 × 9th.		
1½ in. Spruce deal.	38½	35	33¾	33½	32½	32	31½ × 18.8	per cent.
1½ Ditto.	30	27	26½	26	26	25	24¾ × 17.5	,,
1 Ditto.	25	23	22	21½	21½	21	20¾ × 17.2	,,
⅝ Ditto.	18	14¾	14½	14½	14½	14	13¾ × 23.8	,,

BREAK OF BUFFERS NOT A NECESSARY CONSEQUENCE OF BREAK OF GAUGE.

Sir,—In an article in your last week's Number, you state that my plan for remedying the break of gauge is objectionable on account of the necessary break of buffers. By a reference to my plan you will find that no such objection can exist. Immediately on the narrow gauge carriages being shifted on to the broad gauge truck, their buffers would cease to act until again placed on the narrow gauge. The broad gauge trucks would be provided with buffers to buff with the broad gauge carriages. Having thus proved, I hope satisfactorily, that according to my arrangements *no break of buffers takes place*, I may fairly claim the invention of the best method hitherto proposed for remedying the break of gauge.

I am, Sir, yours, &c.,
H. H. Henson.

Hampstead, August 24, 1847.

BELL'S IMPROVED LOAM MOULDERS' CRANE.

Sir,—I forward to you a sketch of an improvement in the Loam Moulders' Crane. It consists in the employment of what may be called a horizontal centre, the utility of which will easily be seen by any one who is in the least acquainted with the moulding trade. It may be applied either to cylinders with branches, or to nozles with branches, or indeed any article made with the moulders' crane. The first trial I made of this improvement was with some large nozles having double branches of 2 feet diameter, and it answered very well. The saving thus arising in the making of patterns is great, no wood being wanted, but only a small board of the shape of the intended branch.

A crane on this plan may be seen at work at the works of Messrs. Fawcett, Preston, and Co., Liverpool.

I am, Sir, yours, &c.,
George Bell.

Digitized by Google

Fig. 1.

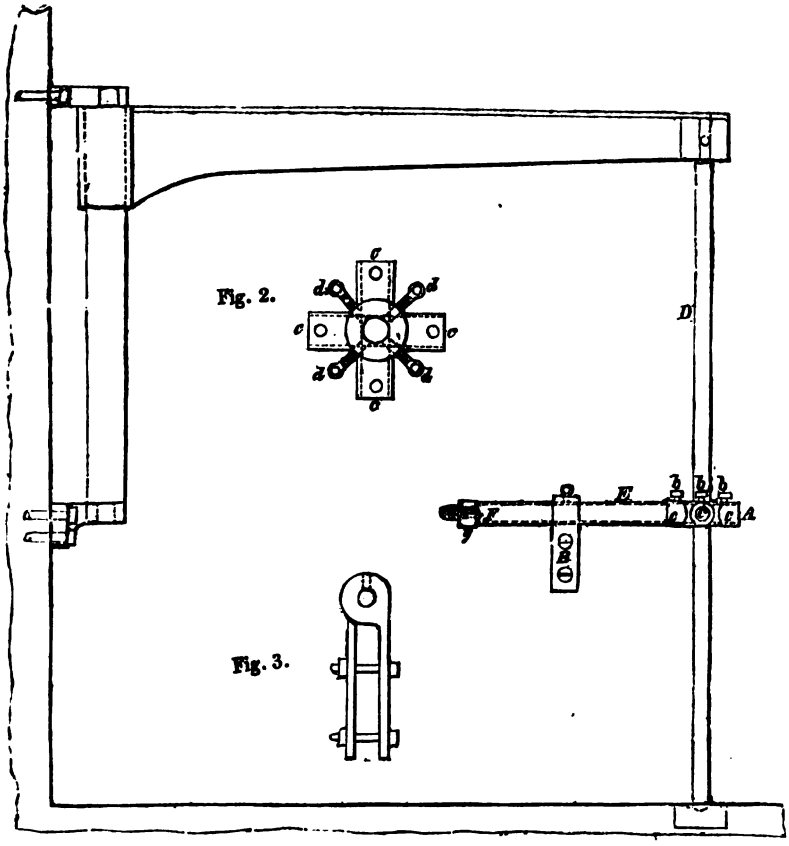


Fig. 2.

Fig. 3.

Description.

Figure 1 is a side elevation of the crane. A is a piece of round cast iron with four bosses *c c c c* cast on it, which is fixed to any length on the spindle D, by four set screws *d d d d*. A plan of this piece is given separately in fig. 2.

E is a tube which will turn on the spindle F, and is kept in its place by the nut *g*. On this tube the chops B are placed; an edge view of which is given separately in fig. 3.

F, a spindle placed in the boss *c* and secured by the set screws *b*. If four branches are required on a pipe, &c., then four spindles and tubes similar to F should be placed in the bosses *c c c c*. There must of course be a hole in the key and centre to stop the upright centre.

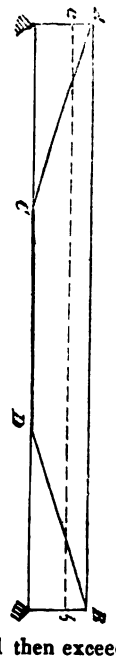
CAST IRON GIRDER BRIDGES—REPLY BY MR. DREDGE TO "A. H."

Sir,—The reason I assumed $\frac{1}{8}L\mu$ to be the weight supported by each prop, E and F, was because these props are supposed to divide the girder into three equal parts; and although I am inclined to admit with "A. H." "that this need not necessarily cause any connection between them," yet in making the assumption I am not at all singular. For instance, in a suspension bridge where the weight of the chains and vertical suspending bars are=0, as compared with the weight of the roadway, it is demonstrable that the curve formed by the

Digitized by Google

chain would be a parabola. Now it is impossible to do this unless we not only assume that the aggregate forces in the vertical rods be equal to the weight of the platform, but also that each particular bar sustains that portion of the platform to which it is attached; and we must therefore assume a symmetrical connection between the forces resisted by each. If, therefore, I am wrong, I share the error with all writers, not only on suspension bridges but on projection generally.

"A. H." is certainly wrong in supposing that the rods AC or BD would be the first to break. For all the material that is situated above the neutral axis *a b* is compressed, and all below it is extended. Now the bars AC or BD are partly above and partly below this line, and they therefore have to resist the action both of tension and compression; and, as these forces exist in the same line, the one neutralizes the other, and it is only the excess of the tensile over the compressive force that would be acting on the bars AC or BD. It was for this reason that I did not consider the action of these bars.



If the bars were attached to separate abutments at their upper extremities instead of being connected with the beam, "A. H." would be quite right in his observations, and the tension in them would then exceed the tension in the central horizontal bar in the proportion of the *cos.* to the *col.* of the ∠ the inclined bars make with the horizon.

I have just been desired by Lord O'Neil to design a bridge on the girder principle to cross a river flowing into Lough Neugh through his lordship's demesne. As there will be something novel in the design, I shall have great pleasure in handing it to you as soon as completed to have your opinion on it.

I am, Sir, yours, &c.,

WILLIAM DREDGE.

Castle Dawson, County Derry,
August 18, 1847.

THE WRECK OF THE "GREAT BRITAIN," AND SALVAGE OF H. M. S. "GORGON."

For several months past the public attention has been kept alive to the fate of the unfortunate *Great Britain*, by paragraph after paragraph describing the progress of certain operations for raising and floating her, which were going on under the direction of Messrs. James and Alexander Bremner, C. E. (all former plans having failed), and which it was confidently predicted would result in the most complete success. All was said to be ready for lifting her on the 13th of July last; and on that day the attempt was made, but failed. On the 14th instant a second attempt was made, and that also has failed. We may now, therefore, be excused for inquiring into the causes of these failures, in order that it may be seen whether the means adopted have been the most judicious that could have been used for the purpose; and whether there really is any such difficulty in the case, as thus, apparently, to set all the engineering skill of the country at defiance.

The plan of the Messrs. Bremner, as described by themselves in a communication to the *Illustrated London News* of the 21st August (which contains some excellent engravings, showing the several stages of these operations), was as follows:

"First, twenty large boxes were made, to contain upwards of thirty tons of sand each. Ten boxes were suspended on each side by strong chains, which went over pullies in the upper part of large vertical baulks of timber, the same chain passing through pullies attached to the side of the ship, thus doubling the weight of sand in the boxes, less the friction; and, it should be added, those boxes in the middle of the ship, opposite the engines, had four powers to each, to prevent straining the ship at that part. Very powerful levers were put to the fore-end, capable of lifting about 190 *tons; and, along the sides opposite the large timbers, formerly on the ship, were also placed levers, capable of lifting about* 200 *tons each. In addition to this lifting power of boxes and levers, was applied screw-power, capable of lifting* 160 *tons. These screws were placed near the hawse-holes, on a stout frame of timber, which was on immense end-wood supports. The levers on the sea side of the ship were ballasted with chains, anchors, and parts of the engine; as also were those on the fore part. The sea had, therefore, little surface to strike against; while*

Digitized by Google

the levers on the land-side of the ship were ballasted by a large iron boat filled with sand."

From this description it will be seen that, with the exception of the 160 tons of screw-power employed, Messrs. Bremner relied on raising the vessel by dint of mere strength or weight alone. How they calculated the weight to be raised, or resistance to be overcome, or whether they made any calculation at all, is not stated; this only appears, that, by suspending weights here, and suspending weights there, amounting in all to about 2000 tons, they expected to start the vessel from her sandy bed. Anything in the way of engineering less skilful or scientific than this, it would be difficult to imagine. However, according to the Messrs. Bremner, the mechanical force they employed—whether hit upon by chance or calculation—was actually sufficient for the purpose. We quote again their own words:

"When the lifting power was about complete, on the 13th of July (spring tide), it was thought advisable, as the good weather was passing, to make the first attempt; when, to the surprise of all on board, *the ship lifted so rapidly, that the valves had to be opened to prevent her going up farther* (*!!!*) The first trial was set about too prematurely, as sufficient preparations had not been made to retain the ship at the required height; consequently, on the receding of the tide, several of the boxes and baulks were injured."

The thing was done, only it had to be undone! Trying to raise her, she rose so rapidly that they were obliged to open the valves, and let in the water to sink her again! So swift was the ascent to the surface of the water, that it was necessary to water-log her, to "prevent her going up *any farther*" (*!!!*) (How much *farther* did they think she might have gone?) No "sufficient preparations" had been made "to retain the ship at the required height," which means, we presume, to keep her afloat; and to provide, therefore, against her sinking again, *sua sponte*, it was thought well to sink her beforehand, *à la noyade Francaise!*

Rendered into plain English, and real matter of fact, we take the statement which we have quoted to mean simply this: The engineers had thought only of what weight against weight would achieve, and taken no heed of what was to become of the lighter weight after it was raised; the vessel *was* started from her bed, but filled almost immediately with water, through holes in her bottom, and consequently sank again to her original position; while the weights, reeling under the great effort they had made, were some upset, and some injured, and all lowered into the mud. Another notable specimen this of engineering! The rudest of heavers could not have managed worse.

To provide against a like disaster on the second attempt, the following arrangements were made:

"Some thousands of small piles were driven, reaching from the surface of the sand to that of the rock; and on these piles were laid foundations for vertical supports, which, by an ingenious contrivance, were made self-acting, so that as the ship rose the shores placed (were intended to place?) themselves. In addition to these shores, were many immense wedges, hauled in at the fore-keel and bilges; stones were also put under her with long shutes from the deck."

The second attempt, however, (August 14,) proved so much worse than the first, that the efficiency of these arrangements was not put to the test. The vessel this time was not moved at all. The tide did not rise high enough. "No tide," says Captain Claxton, "only 6 feet 6; we want 13 feet 6; and tide-table gave it. * * They (Messrs. Bremner) have been beat this time by the elements."

That the same weights which lifted the vessel "so rapidly" on the first occasion should not have been able to move her at all on the second, is, it must be confessed, somewhat strange—the "elements" notwithstanding; and the only way in which we can account for it (without impeaching the veracity of the account given of the first experiment, which we see no reason for doing) is, that the vessel must between the two attempts have imbedded herself in the sand more deeply than ever.

A third attempt to raise the vessel is, it seems, to be made in the course of a few days, when "very high spring tides" are anticipated.

We will not go so far as to say that there is no likelihood of success; for as long as it cannot be gainsaid that a weight of 10 lbs. will raise one of 5, there is no doubt that the thing can be done in the way Messrs. Bremner propose. But this we will unhesitatingly affirm,

Digitized by Google

that if she ever is raised, it will not be by means of any ingenuity, skill, or science, which these gentlemen have brought to bear on the task. A vulgar reliance on brute force is the broad feature of all their contrivances; they rely on it to raise the vessel, and they rely on it also to keep it up when raised. Of the aids which hydrostatics and pneumatics offer for the purpose, they are manifestly in most deplorable ignorance.

The owners of the *Great Britain* have spoken somewhat sneeringly on several occasions of the number of schemes for saving her with which they have been "pestered." We once thought them ignorantly supercilious on the matter; but if we may take it for granted, that the plan of Messrs. Bremner was the best of the lot, we must needs confess that they judged shrewdly enough. Was it really, however, the best? Or did they prefer it simply because it was more in conformity than any other with their own notions of the mechanical powers? We should not be *greatly* surprised if the latter supposition were the truer one of the two.

We know nothing of any of the schemes submitted to the Directors of the Great Western Company, and do not now speak disparagingly of the operations of Messrs. Bremner, with the view of favouring any of them. In what we have to say farther on the subject we shall confine ourselves to plans which were prepared and put in successful practice long *before* the *Great Britain* was wrecked in Dundrum Bay; and rest content with asking in conclusion, why the same plans should not have been followed in the case of the *Great Britain*, and should not now (supposing attempt the third to fail) be had recourse to?

In 1828, Mr. John Milne, of Edinburgh, published a work intituled "Plans for the Floating off of Stranded Vessels, and for Raising those that have Foundered, with an Improved Method of carrying Vessels over Banks and Shallow Water." An account of this work was given in the *Mechanics' Magazine*, vol. xx., p. 835. Mr. Milne proposes to employ in various ways the power of vessels, or buoys, filled with air (*not sand*) to raise stranded vessels:

"While it is yet low water let a number of these buoys (or light leather bags) in a perfectly collapsed state be stowed away about the cabin of the wreck, in its hold and steerage, and let them be also confined down near to the bottom of the shattered ship, by cross and upright spars, butting against the under side of its deck; and let an injection pipe communicate with the blowing-pump within the steam-vessel (salvage vessel employed for the occasion), which may, during the operation of filling these buoys, be at any convenient distance from the wreck. Let the blow-pipe now begin to act, by which the buoys will soon be filled, and the wreck will float off when the tide has risen to a sufficient height; for the buoyant effect of the volume of air placed within these envelopes is equal to the weight of a mass of water of the same magnitude; and since the weight of a cubic foot of sea water is a little more than 64 pounds avoirdupois, it does not seem to require the injection of many cubic feet of air to be equal to the weight of even a large wreck while in water, which, being afloat, may now be towed into port by the steam-vessel; and when on its passage, if it were found that the air escaped from its envelopes, they might be kept perfectly full by the air-pump continuing to discharge a sufficient supply into them by the communicating pipe already mentioned."

The reader will be instantly struck by this remarkable feature of the plan of Mr. Milne, that the same power which is employed to raise the vessel serves afterwards to *keep it afloat*, and to carry into port; while the plan of Messrs. Bremner provides but for raising the vessel and leaving it where it was—liberated only from its hold on the shore.

In 1833, Dr. John Hancock recalled attention to this mode of raising vessels in a communication to the *Mechanics' Magazine*, vol. xx., p. 170, and strongly urged its general adoption.

Not many years later we heard of something like it having been actually adopted in several instances with great success by Mr. Bush, the ingenious, enterprising, but most ill-used constructor of the "Light for All Nations." The first case was that of the *Nimble* cutter which was wrecked in October, 1837, on the Corton sands; and another, that of the *Blucher*, which sunk in three fathoms water off the Naze; both of which vessels Mr. Bush succeeded in raising and carrying into port. Mr. Bush's plans differed from Mr. Milne's chiefly in this; that he made use of empty casks and hollow cones, instead of flexible air buoys, and had, consequently, all that trouble to encounter which it was Mr. Milne's object to ob-

Digitized by Google

viate, namely, the great trouble inseparable from every attempt to attach a number of rigid hollow bodies to a vessel under water.

We would not have our readers to suppose, from what we have said, that we mean to represent the employment of air-vessels for raising sunken vessels as dating from the publication of Mr. Milne's book. The fact is not so. Empty casks had been employed, in one way or another for the purpose, time out of mind; and camels (the invention of the Dutch), which differ but in bulk and shape from casks, had also been known for a century and more. Mr. Milne himself states, that he was well aware of these contrivances, and aimed only at improving upon them. What he did was to suggest the employment of flexible, instead of rigid air-vessels; the attachment of them, in a collapsed state, to the vessel, both inside and outside; and the inflation of them with air after they are so attached. Most valuable suggestions these were, and, according to the best of our knowledge, perfectly original.

The progress of the arts since the date of Mr. Milne's book, has tended greatly to enhance the value of his plans. Caoutchouc was then unknown, except as a material for rubbing out lead-pencil marks (*unde derivatur* INDIA-RUBBER, *Angl.*, LEADEATER, *Scott.*); and well greased leather was the best material Mr. Milne could think of for making his flexible bags. But now that caoutchouc has come to be applied so extensively in the sheet state, and in a state of solution, to the manufacture of air and waterproof elastic fabrics,—now that air-balls, and air-cushions, and air-beds made of, or with the aid of caoutchouc, are become articles in common use,—the ship salvor has at his command a material incomparably superior to leather, and one with the aid of which he may carry out Mr. Milne's views with a facility far beyond what the inventor himself could ever have anticipated. Caoutchouc bags contract and expand, which leathern bags do not. Caoutchouc bags may be made perfectly impermeable to both water and air, which leathern never can. And caoutchouc bags may be stowed away in a tenth of the space which would be required for the others. A very small cabin would suffice to hold as many caoutchouc bags as would raise the biggest ship that ever floated.

The Americans have in this, as in not a few other instances, been quicker than the English to appreciate the advantages of employing caoutchouc bags in the salvage of ships. We quote the following notice from a recent number of the *Baltimore Sun*:

"*Marine Camels.*

"We on Monday witnessed an experiment made at the U. S. receiving ship Ontario, of the power of the marine camels, the invention of Captain Taylor. The camels are simply India-rubber canvas bags, made so as to retain all the air which may be pumped into them. They may be placed under any vessel which it may be desired to raise out of the water, and in proportion to the amount of air forced into them, the ship will rise. The sloop of war under which the camels had been placed, was raised three feet in less than one hour and a half; the camels, if we may use the expression, being fed by a small air-pump, worked by but one set of hands. It was evident, from what was done, that she might have been raised, with sufficient power, we may say, almost out of the water. The design of this invention is to carry ships over bars, or to relieve vessels which may ground on a bar."

Why should not the directors of the Great Western Company (the owners of the *Great Britain*) go and do likewise? If Messrs. Bremner succeed in their third attempt—which we have admitted to be a *possible* case—there will be no occasion to call in other aid; but if they fail once more, as is likely enough, the directors will be inexcusable if they do not have recourse to the well-tested and infallible means which we have here brought under their notice.

Before laying aside our pen, it may not be out of place to add a word or two with respect to another great wreckage case which, two years ago, excited nearly as much sensation as that of the *Great Britain*. We refer to the case of H. M. steamer *Gorgon*, of 1100 tons burthen, Captain Hotham, commander, which was stranded in the Bay of Monte Video, May 10th, 1844; and after upwards of five months of incredible exertion on the part of her officers and crew, restored, nearly uninjured, to her native element. A "Narrative of the Recovery"* of this vessel has been published by Commander Astley Cooper Key, one of the lieutenants of the *Gor-*

* 8vo., 112 pp., with numerous plates. Smith and Elder. 1847.

Digitized by Google

gon at the time of the disaster, which, though written more particularly for the information of members of the author's own profession, is deserving an attentive perusal by all who are, or may be, in any way concerned with the salvage of vessels. The fertility of invention evinced by Captain Hotham on the occasion, the ingenuity and frequent originality of his plans, the sagacity with which difficulties were foreseen and provided against, the judgment with which orders were given and cheerfulness with which obeyed, and the unflinching energy and perseverance displayed by all concerned, from first to last, have found in Commander Key a faithful and most agreeable chronicler. Although we cannot cite the *Gorgon* as an instance of a vessel saved by the sort of agency we have been recommending (for she was saved chiefly by shore purchases and screws), yet we can cite both her commander and the writer of the "Narrative," as bearing unqualified testimony to the superiority of that agency over all others. Captain Hotham did, in fact, have recourse to the use of camels, and derived great assistance from them; but, owing to an accident, described in the following interesting extracts, they were put *hors de combat* before the ultimate rescue of the vessel by other means:

"This day's experience (22nd August) was bitter; it showed clearly that the general means adopted were inadequate to the accomplishment of the undertaking. The camels were our only resource * * * The advantage of the camel in reducing the draught of water, especially in a case like the present, is so obvious, that the inquiry would naturally suggest itself, why were they not earlier thought of, and brought into use? This is easily answered; in the first place, economy required that the means which were considered adequate, should be *proved* not to be so, before others were resorted to; and secondly, the excavations in the dock were only *now* sufficiently advanced to admit them."

* * * *

"On the 16th of September, at about mid-day, a sudden squall from the southward caused the water to rush into the bay with such force as to raise it three feet in a few minutes, bringing it therefore on a level with the top of the camels. When the camels were totally immersed, and were exerting their whole power, *they had the immediate effect of bringing the ship upright.*"

* * * *

"We had been assured that after October, all hope of any extraordinary rise of tide was at an end; from the commencement of that month, therefore, every indication of a southerly gale was watched with increased anxiety; we considered ourselves in every way prepared, our only daily employment consisted in the continued excavation of the dock and channel, which would admit of no cessation. At any ordinary rise of water, to the ten-feet mark, for instance, the ship was evidently quite alive abaft, the slightest swell setting into the bay was sufficient to cause *the immense power of the camels to be immediately perceived*, by the motion they communicated to the ship; if either of them on one side sprung a leak, which occurred once or twice, the ship instantly lifted over two or three degrees to that side, and again righted when the camel was repaired and pumped out dry."

* * * *

"Before relating the account of our final happy release, let us pause, to remind the reader what power was at the present period applied, after all the changes and alterations that had taken place, and which have been so confusedly recounted in the preceding pages. And, first, as to the lifting power, or that applied to lessen the ship's draught of water: The *amount* of this is easily ascertained; but the actual *effect*, that is to say, the exact reduction, is not so simple in the attainment: the investigation would involve more delicate and abstruse calculation than is consistent with the character of this publication. The form of the ship's bottom, her exact displacement, and other data, would also be necessary, before any result, in the slightest degree approximating the truth, could be obtained. Let us therefore be content with the mere amount of power, which may be tabulated thus:

Port side.	Tons.	Starboard side	Tons.	Astern.	Tons.
Camel (1)	56	Camel (2)	64	Caisson	5"
,, (3)	63	,, (4)	49		
,, (5)	76	,, (6)	66		
Boilers	10	Tanks.....	14		
16 Pipes.....	8	10 Pipes.....	5		
	213		198		

Digitized by Google

Summary.

	Tons.
Port side	213
Starboard side	198
Astern	57
Total.....	468

Showing a total of 468 tons directly applied to reduce the ship's draught; and, from the description of power, every ton is clearly and inevitably available. There is no loss from friction, or bad material: no doubt as to the proper force being exerted, as is the case with animal power; the machines are in themselves helpless; they are forced to put forth their whole strength; and, as long as they are entirely immersed, there can be no relaxation or diminution to their exertions."

* * * *

"The ship had been dragged her whole length when No. (1) camel slipped from its shores, and rising, the surf struck it heavily against the ship's side, by which it was stove; soon the whole of the camels followed its bad example; this was grievous indeed, but the ship was now entering the mud, and continued to move, though more heavily than before."

* * * *

"The reason of the defection of the camels was very evident. The gripes, by which they were housed close to the ship's side, were made fast below the camels to the swifter; to this, at the stern post, was also secured the standing parts of the runners on the heaving-off cables; therefore, when these carried away, and were unrove, the swifter, of course, slacked: this gave the camels a little play, which was increased rapidly by the swell, and finally, so as to trip up the shores; they were then completely adrift."

* * * *

"The ship was still imbedded four feet in the mud, which was now considerably softer than that nearer to the sand. But as we now were assured that she could be dragged astern by main strength, and at little more than an ordinary tide, the intention of re-securing the camels and 'caisson' was, of course, abandoned."

The engines of the *Gorgon* were employed as the principal moving power in working the purchases and screws, and the author of the "Narrative" claims for Captain Hotham the merit of having been the first to turn to so useful an account what had previously been regarded as one of the greatest obstacles to the salvage of a vessel under such circumstances:

"I believe it may be with propriety assumed that a very general impression has prevailed in the navy, that one of the great difficulties attendant on officers commanding steamers would be, getting them afloat, should any disaster throw them on shore. The necessity of removing the engines was always admitted; and the minds of naval men had been turned to simplify a process considered as a *sine quâ non*. It was reserved for the *Gorgon*, a vessel with engines of 300 tons weight, to prove to the world that an officer should consider well his position, before he adopted too hastily a plan that would inevitably render his vessel at once unserviceable. As a matter of course, the advantage to be gained by their removal struck every one; but this was more than counterbalanced by the difficulties attending the operation, the expense to be incurred, and the probable loss or injury of many small parts, and more than all, by the declaration of the engineers that the resources at their command were *not* sufficient for their restoration and re-erection. Weighing well the advantages and disadvantages held out by either course, it was wisely determined to retain them, and employ them as the principal moving power; but, as is, and ever will be the case, when any new idea is started, public opinion declared against it, the folly and madness of the plan was in the mouths of every body; still Captain Hotham remained firm, in defiance of the entreaties of his friends, and the ill-repressed hints of other self-constituted critics. His determination was that the engines should remain on board, and be used as the principal power for transporting the ship."

We have quoted the preceding passage with a special view to its bearing on the case of the *Great Britain*. 'Should recourse be had to the use of air bags, a considerable power will be required to inflate them; and Captain Hotham's example shows that none better can be employed than that which the vessel's own engines afford.

Digitized by Google

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 166.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

Moses Bird, of Walsall, Stafford, locksmith: of a guarded lock, bolt, or box, to be applied to the bolt for the better securing of locks, latches, bars, and turnbuckles, which will be of great use in securing sashes in the frames, doors, drawers, desks, and bureaus from being opened by any picklock or false instrument. Cl. R., 30 Geo. 3, p. 17, No. 1. October 29, now last past; Nov. 27, 1790.

William Whitmore, of Birmingham, tool maker: of a method of making shanks or eyes for buttons by the application of rollers, presses, and other implements. Cl. R., 30 Geo. 3, p. 18, No. 2. Nov. 16, 21 Geo. 3; Dec. 11, 31 Geo. 3, 1790.

William Redman, of New Sarum, Wilts, tin plate worker: of a new-invented iron back, adapted to all sorts of stoves and grates used in fire-places in rooms, which, by rarifying the air, will accelerate and impel the ascension of the smoke, cause the fire in the grate to burn free and clear, prevent any smoke in the room, and give a much greater heat than stoves or grates without such backs will do. Cl. R., 30 Geo. 3, 23, No. 20. July 28, 30 Geo. 2, August 24, 1790.

James Frost, of Norwich, carpenter: of new-invented and improved methods of constructing, fixing, and arranging window lights and sashes of all descriptions whatsoever: [consisting: 1ly. In forming window sashes of metal, cast either whole or in parts as may be found necessary, and with mitre joints complete, both in the mouldings and rabbets intending to hold the glass; 2ly. In forming molds for casting these new-invented window sashes of brass or of iron, or of other metals, either by themselves or compounded, or of sand, clay, or other composition.] Cl. R., 30 Geo. 3, p. 28, No. 1. April 27, 30 Geo. 3; May 27, 30 Geo. 3, 1790.

Adam Heslop, of Ketley, Salop, engineer: of an invention of an engine for lessening the consumption of steam and fuel in fire or steam engines, and gaining considerable effect in time and force. Cl. R., 30 Geo. 3, p. 31, No. 1. July 17, 30 Geo. 3; Aug. 16, 1790.

John Syeds, of Southwark, mariner: of a new machine or instrument, called an improved quadrant, for determining the altitude at sea when no horizon can be found, and for the easier ascertaining the longitude. Cl. R., 31 Geo. 3, p. 1, No. 5. Jan. 21, 31 Geo. 3; Feb. 14, 31 Geo. 3, 1791.

William Dufour, of Marylebone, gent.: of an invention of a machine, called a sliding balcony, or private family fire escape, for the preservation of lives and property from the dreadful effects of fire. Cl. R., 31 Geo. 3, p. 1, No. 4. Jan. 24, 31 Geo. 3; Feb. 18, 1791.

Isaac Manwaring, of Clerkenwell, sawmaker: of a new invention for making a pendulum steam engine, with two or more cylinders, to work immediately upon a wheel or wheels without a crank, long beam, or lever, as now used, and in a manner different from the hitherto accustomed mode of working steam engines, which may be either in the whole or by the several parts thereof applied to any works where great power or force is required, and equally applicable to the raising of water, &c., &c. Cl. R., 31 Geo. 3, p. 2, No. 19. Feb. 10, 31 Geo. 3; March 10, 1791.

William Shorland, of Bristol, millwright and engineer: of a new-invented mill, machine, or machinery, calculated to prevent mills and all kinds of works, drove by water, from being flooded or impeded by back or tail water, through the operation and effect of double power, overshot-wheels, and floodgates, and for grinding, &c. of every species of grain, foreign or domestic produce, and the powdering and whitening of every sort of sugar; such mill, machine, or machinery to be worked either by water, wind, manual labour, steam, horses, or any other cattle. Cl. R., 31 Geo. 3, p. 2, No. 16. March 3, 31 Geo. 3; March 21, 1791.

John Bevans, of Clerkenwell, joiner: of a new method of making circular wooden sash frames, sashes, and soffits, fanlights, doors, mouldings, and hand-rails for stairs. [By bending them in one entire piece, if the wood be of sufficient length, with the help of hot water, steam, and certain machinery.] Cl. R., 31 Geo. 3, p. 2, No. 7. April 4 instant; April 21, 31 Geo. 3, 1791.

Colin Mackenzie, of Oxford Market, Mary-le-bone: whitesmith: of a new-invented link for a chain, and a certain way and method of making a chain of such links by uniting the same, and which may be used as a mooring chain, ship cable, watch chain, or for any other purpose where a chain can be used, and which can be lengthened or shortened at pleasure by adding or taking away such links without cutting or breaking any

Digitized by Google

one or more of them. Cl. R., 31 Geo. 3, p. 4, No. 2. August 13, 31 Geo. 3; Sept. 12, 1791.

William Jayne, of Sheffield, confectioner: of an ivention of a composition or mixture for keeping and preserving perfectly sound for the space of two years at the least the eggs of hens, turkeys, geese, and ducks. Cl. R., 31 Geo. 3, p. 13, No. 1. Feb. 8, 31 Geo. 3; Feb. 22, 1791.

Thomas Mead, of Sculcoates, (York,) engineer: of an invention of "a reciprocating fire or steam engine or machine, upon an entire new principle, for the use of mills, pumps, cranes, carriages, and other purposes, where the force of fire or steam is required." What particularly relates to the invention is the heating and rarefying the elastic fluid after it has left the boiler, and afterwards causing it to pass through the denser fluid in the same, by which means the engine is kept in motion with a less consumption of fuel than by other methods now in use, and at a considerable less expense. Cl. R., 31 Geo. 3, p. 20, No, 3. August 12, 31 Geo. 3; September 3, 1791.

James Summers, of Laurence-hill, Gloucester, wheelwright: of an invention of constructing a steam engine, by which may be worked mills for grinding, rolling, cutting, turning, or any other sort of machine that can be wrought by water with the greatest degree of uniformity, by a new-invented figure, called the Sub Supra, and others connected therewith, by which means such engine will have a superior power above any of the common construction. [To this engine may be applied the new-invented machine, called The Hydraufical Index or Steam Regulation, which keeps the motion of the engine as regular as possible.] Cl. R., 31 Geo. 3, p. 23, No. 14. October 6, 31 Geo. 3; No. 4, 1791.

(*To be continued.*)

NOTES AND NOTICES.

An Ice Mountain.—De Smet, an English missionary, in writing to the *Freeman's Journal* from Oregon says:—"Not far from the place of our encampment we found a new object of surprise and admiration. An immense mountain of pure ice, 1,500 feet high, enclosed between two enormous rocks. So great is the transparency of this beautiful ice, that we can easily distinguish objects in it to the depth of more than 6 feet. One would say by its appearance, that in some sudden and extraordinary swell of the river, immense icebergs had been forced between these rocks, and had piled themselves on one another, so as to form this magnificent glacier. From the base of this gigantic iceberg, the river Trou takes its rise."

Encouragement to the Blue Dahlia Seekers.—A singular phenomenon, says a French paper, has shown itself in a greenhouse at Lyons. At the time when all the growers of camellias, roses, dahlias, &c., are puzzling themselves to get the blue colour, the only shade which nature has refused to these kinds of plants, chance has thrown a shade of azure blue upon the petals of flowers produced by one single branch of a camelia root of the species *imbricata rubra*. This plant belongs to M. Dagene. The interior petals of the flowers are of a delicate red, the superior are white, and both are united with blue. The flower thus unites three additional colours.

No Proof of the Present Existence of a Single Star or Planet—Sir John Herschel, in an "Essay on the Power of the Telescope to penetrate into Space,"—a quality distinct from the magnifying power, informs us that there are stars so infinitely remote as to be situated at the distance of *twelve millions of millions of millions of miles* from our earth; so that light, which travels with a velocity of twelve millions of miles in a minute, would require *two millions of years* for its transit from those distant orbs to our own; while the astronomer who should record the aspect or mutations of such a star, would be relating, not its history at the present day, *but that which took place two millions of years gone by!*

A Cheap Signal Light.—The *Revue du Havre* states that a young chemist of that town has invented a system of lights for ports and coasts, consisting of a thick globe of glass, in which is enclosed a preparation giving a light like that of the moon, the cost of which for one year will not exceed a franc.

Tortoise-shell Bonnets.—In the British Museum there is a tortoise-shell bonnet shown, which came from Navigator's Island, and was presented to the institution by her present Majesty.

A Dear Table.—Cicero is said to have first brought into fashion at Rome tables of tiger and panther wood. He gave for one a million of sesterces, (£8072.)

Berlin Castings.—Ehrenberg states that the peculiar fineness of these castings is owing to the iron and sand employed being of a peculiar quality, and only to be met with in the neighbourhood of Berlin. The former is made from bog-ore, and the latter is a sort of tripoli, containing a considerable admixture of iron.

The Partridge and Penang Canes, so much in vogue, are made from the cocoa-nut palm of South America—one of that endogenous tribe of plants which have only one set of fibres, and those vertical, which exhibit in their transverse section the irregular dots so much admired.

Improvements in Gun-cotton.—Mr. Coathupe recently forwarded to the Chemical Society two specimens of gun-cotton, with a view to illustrate the greatly increased explosive effects that are to be derived from a subsequent immersion of the gun-cotton, when properly prepared in the ordinary way, in a saturated solution of chlorate of potash. "Having experimented with solutions of nitrate of ammonia, nitrate of potash, nitrate of soda, bichromate of potash, &c., for the purpose of increasing the explosive properties of this interesting substance, I can affirm that none of the results will bear the slightest comparison with those obtained from the solution of chlorate of potash, either in rapidity of ignition or in intensity of flame. The process adopted for preparing the enclosed specimens was as follows—viz.: into a mixture of equal measures of strong nitrous acid, and of oil of vitriol, spec. grav. 1·845, the cotton was immersed and stirred with a glass rod during about three minutes, it was then well washed in many waters, and dried; a portion of it was then soaked for a few minutes in a saturated solution of chlorate of potash, well squeezed and dried."

Navigating against the Wind.—Gardner, in his travels in Brazil, relates an expedient by which his Indian guides succeeded in navigating against a violent wind down one of the rivers of that country. They went ashore, and cutting off a considerable quantity of branches from the trees, which there grew in abundance, they tied them tightly around the middle with a cord, one end of which they attached to the canoe. Then steering for that part of the stream where the current was the strongest,

Digitized by Google

they threw the bundle overboard, which, from its green state, sank just below the surface of the water, and being thus secure from the influence of the winds, the canoe was carried rapidly down the stream.

The Power of the Press.—In the year 1272, the wages of a labouring man were just three half pence per day; and at the same period, the price of a Bible well written out was £30 sterling. Of course, a common labourer in those days could not have procured a Bible with less than the entire earnings of thirteen years! Now, a beautifully printed copy of the same book can be purchased with the earnings of half a day!

A Tunnel under the St. Lawrence.—It is proposed to tunnel the St. Lawrence, opposite the island of Montreal, in order to connect the railroad running to the Atlantic. The proposed tunnel under the St. Lawrence at its narrowest part, near St. Helen's Island, will be about one-third of a mile from shore to shore, and about one-third the length of the principal tunnels in England. The depth of the water in the river is 43 feet.

A Novel Salute.—When General Washington, while president, visited the works of the James River canal, the chief engineer caused the quarriers to charge some hundreds of blasts, which were exploded at Washington's approach. This internal navigation salute he pronounced the most gratifying he had ever heard.

The Atmospheric Railway System.—The South Devon line, from this city to Teignmouth, has this day been worked throughout with the most complete success. The distance from this city to Teignmouth, including stoppages at Starcross and Dawlish, was performed in 42 minutes, with the utmost ease and precision. It is expected that all the transit will be made by the atmospheric in the course of a day or two! So much for the croakers!—*Besley's Exeter News.*

DREADFUL STEAM-BOAT EXPLOSION.

The *Cricket*, one of the A. B. C. steam-boats which ply on the river at halfpenny fares, has been blown up this morning (Friday), while taking in passengers at Hungerford Bridge Pier. A great many people have lost their lives, and many more have been wounded. The engines were on the high-pressure principle, and will be found described in this journal for 11th July, 1846 (No. 1196).

LIST OF ENGLISH PATENTS GRANTED FROM AUGUST 19 TO AUGUST 23, 1847.

Edward William Eaton, of New Windsor, Berks, bachelor of medicine, for certain improved machinery for preventing accidents by railway. August 19: six months.

Osborne Reynold, of Dedham, Essex, clerk, for improvements in making hop-poles, hurdles, fencing-ropes, basket or wicker work, and other similar articles. August 19; six months.

William Bacon, of Bury, Lancashire, engineer, and Thomas Dixon, of the same place, engineer, for certain improvements in steam-engines. August 19; six months.

William Eaton, of Camberwell, Surrey, engineer, for certain improvements in raising water and other liquids from one level to another. August 19; six months.

Orlando Brothers, of Blackburn, Lancashire, engineer, for certain improvements in the method of manufacturing retorts, and in the machinery or apparatus connected therewith. August 19; six months.

Archibald Farries, of Preston, Lancashire, gentleman, for improvements in propelling carriages on common roads. August 19; six months.

Francois Augustus Renard, of 40, Rue du Rocher, Paris, for improvements in preserving and colouring wood. August 19: six months.

James Webster, of Sneinton, Nottingham, engineer, for an atmospheric buffer to be applied to carriages and other vehicles travelling on railways. August 19; six months.

Aime Bowra, of Rathbone-place, Middlesex, dyer and scourer, for improvements in colouring matters. August 19; six months.

Alexander Speid Livingstone, of No. 7, Bridge-place, Lewisham, Kent, civil engineer, for certain improvements in the construction of locomotive engines intended to be used on railways. August 23; six months.

Thomas Dansom Pruday, of the Freemasons' Tavern, Great Queen-street, Middlesex, cook, for certain improvements in apparatus for reducing vegetable and other substances to small particles. August 23; six months.

MONTHLY LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 27TH OF JULY TO THE 20TH OF AUGUST, 1847.

John Yule, of Sauchiehall-street, Glasgow, Britain, for certain improvements in chairs used on railways, and in fixing the same. July 27.

Henry Mapple, William Brown, and James Lodge Mapple, of Child's Hill, Hendon, for improvements in communicating intelligence by means of electricity, and in apparatus relating thereto; part of which improvements are also applicable to other purposes. August 2.

Moses Poole, of London, gentleman, for improvements in the manufacture of cast metal, iron, and steel. (Being a communication from abroad.) August 5.

Robert Stirling Newall, of Gateshead, Esq., for certain improvements in locomotive engines. August 6.

John Macintosh, of Bedford-square, Middlesex, gentleman, for improvements in engines to be worked by steam or other suitable fluid, and improvements in propelling carriages and vessels. August 6.

William Thomas, of 129, Cheapside, London, merchant, for certain improvements in stays, which improvements are applicable to other useful purposes. (Being a communication from abroad.) August 11.

Pierre Armande Le Comte de Fontainemoreau, of 4, South-street, Finsbury, London, for certain improvements in the machinery for cutting wood, and in laying and uniting veneers. (Being a communication from abroad.) August 11.

James Webster, of Sneinton, Nottingham, for an improved atmospheric buffer to be applied to railway carriages and other vehicles travelling on railways. August 12.

John Thompson Carter, of Drogheda, of the county of the town of Drogheda, in Ireland, flax-spinner, for improvements in machinery for crushing, bruising, and preparing flax, hemp, and other fibrous materials requiring such treatment. August 16.

Frederick Steiner, of Hyndburn-cottage, near Accrington, Lancaster, Turkey red dyer, for improvements in the manufacture of sugar. (Being a communication from abroad.) August 16.

Thomas Birchall, of Ribbleton-hall, Lancaster, gentleman, for improvements in folding newspapers and other papers. August 16.

James Morison, of Paisley, of Renfrew, shawl manufacturer, for improvements in applying power in propelling or moving carriages, and in giving motion to machinery. August 18.

Philip Henry Holland, of Charlton-upon-Medlock, Manchester, Lancaster, surgeon, for improvements in applying manure to land. (Being a communication from abroad.) August 20.

Digitized by Google

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Aug. 19	1169	Turner and Pegg	Leicester	Rectangular woven elastic bands.
,,	1170	Edward Gadsby	Noble-street, Cheapside	Improved buckle for braces, and other purposes.
20	1171	James Comins	King-street, South Molton, Devon, whitesmith	Improved one-way turn-over, or turn-rest plough; also a hoeing, earthing-up, or potato plough.
21	1172	Henry Summersgill	24, Nile-street, Church-street, Preston, Lancaster, watchmaker	An improved going barrel, or main-spring box, for watches.
,,	1173	Brown, Marshall, & Co.	Birmingham	Improved spring roller for glass frames, to be applied to railway and other carriages.
,,	1174	William Wharton	London and North Western Railway Station, Euston-square	A continuous band.
23	1175	Charles Dowse	Camden Town	Memorandum book.
24	1176	John Duffell	Birmingham	Steel mill.
,,	1177	Lawson and Holden	Birmingham	Railway roof-lamp.
26	1178	François Teychenne, James Waterman, and Phillip Powell	Cripplegate, London, feather merchants	Pillow, or cushion.

Advertisements.

TO MINE AND COLLIERY PROPRIETORS, SLATE QUARRY OWNERS, RAILWAY CONTRACTORS, IRONMONGERS, DEALERS IN GUNPOWDER, AND OTHERS.

MESSRS. JOHN HALL AND SON, THE PATENTEES AND SOLE MANUFACTURERS OF

SCHONBEIN'S PATENT GUN-COTTON,

Respectfully state, that they are now prepared to SUPPLY the PATENT GUN-COTTON (compressed for the convenience of carriage), in round and square paper cases, of 4 ozs. each, packed in boxes, containing 50 and 100 cases each, at the price of 3s. per lb., for ready money.

Also, in tubes or cartridges of... 1, 1½, 1½, and 1¾ inch diameter;
Containing ..... 2, 4, 6, and 8 ounces each, at the
Additional charge of..... 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 3 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

Office, 23, *Lombard-street, London.*

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs T. Burnell and Co., 1, Great Winchester-street, London.

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings, and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Patent Bells.

MESSRS. MEARS beg to call the attention of the Trade and the Public generally to these articles, which they are now prepared to supply in any quantity and variety. The composition is of a new metal, called the Union Metal, and the bells are of very beautiful tone, and cheaper than those made of the ordinary bell metal. Orders received at the Bell Foundry, Whitechapel, for house, cattle, and other bells.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3d.; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are, that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

Now Ready, in one vol. 8vo., Illustrated with 530 Wood-engravings and Two Coloured Plates, price 18s. in cloth, being Vol. I. of the Library of Illustrated Standard Scientific Works,

MULLER'S PRINCIPLES OF PHYSICS AND METEOROLOGY. Translated from the German.

"The Physics of Müller is a work superb, complete, unique: the greatest want known to English science could not have been better supplied; the work is of surpassing interest. The value of this contribution to the scientific records of this country may be duly estimated by the fact that the cost of the original drawings and engravings alone has exceeded the sum of £2000."—*Lancet*, March 1847.

A Prospectus of the Series, with specimens of the Wood-cuts, may be had on application.

H. Baillière, Publisher, 219, Regent-street.

CONTENTS OF THIS NUMBER.

Description of Wrigg's Patent Self-Carrying Railway Carriage for Common Roads, Fields, &c.—(*with engravings*) 194
Remarks on the Use of Mathematical Knowledge to Engineers, and Hints to those who have not the Benefit of a Tutor—(*continued*) 197
Brown's Disinfecting Processes and Artificial Manures—(Specification) 200
Davison and Symington's Patent Desiccating Processes 202
Break of Buffers not a necessary consequence of Break of Gauge. By H. H. Henson, Esq. 204
Bell's Improved Loam Moulders' Crane—(*with engravings*) 204
Cast Iron Girder Bridges. Mr. Dredge in Reply to "A. H." 205
The Wreck of the "Great Britain," and Salvage of H. M. S. "Gorgon" 206
Calendar of Specifications—(*continued*) 212
Notes and Notices 213
Dreadful Steamboat Explosion 214
Weekly List of New English Patents. 214
Monthly List of Scotch Patents 214
Weekly List of Articles of Utility Registered... 215
Advertisements 215

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1256.] SATURDAY, SEPTEMBER 4. [Price 3d.

Edited by J. C. Robertson, 166 Fleet-street.

MR. BRAITHWAITE'S PATENT IMPROVEMENTS IN HEATING, LIGHTING, AND VENTILATING.

Fig. 1.

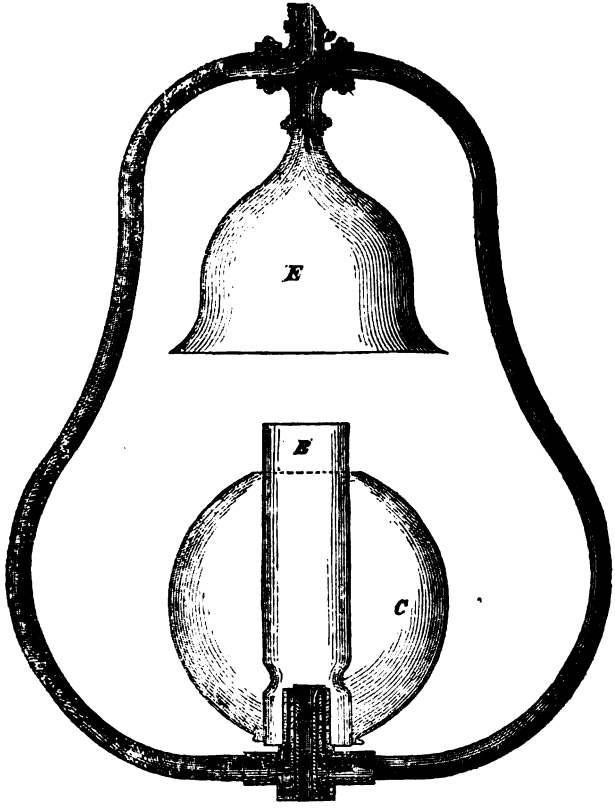


Fig. 3.

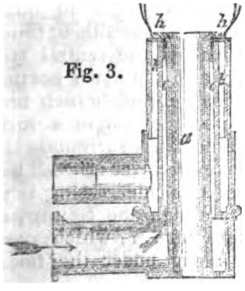
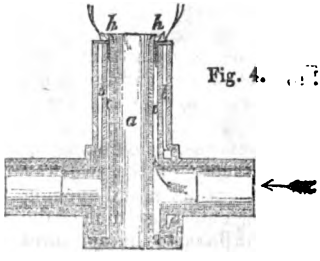


Fig. 4.



Digitized by Google

MR. BRAITHWAITE'S IMPROVEMENTS IN HEATING, LIGHTING, AND VENTILATING.

[Patent dated 28th January, 1847. Patentee, John Braithwaite, Esq., C. E.]

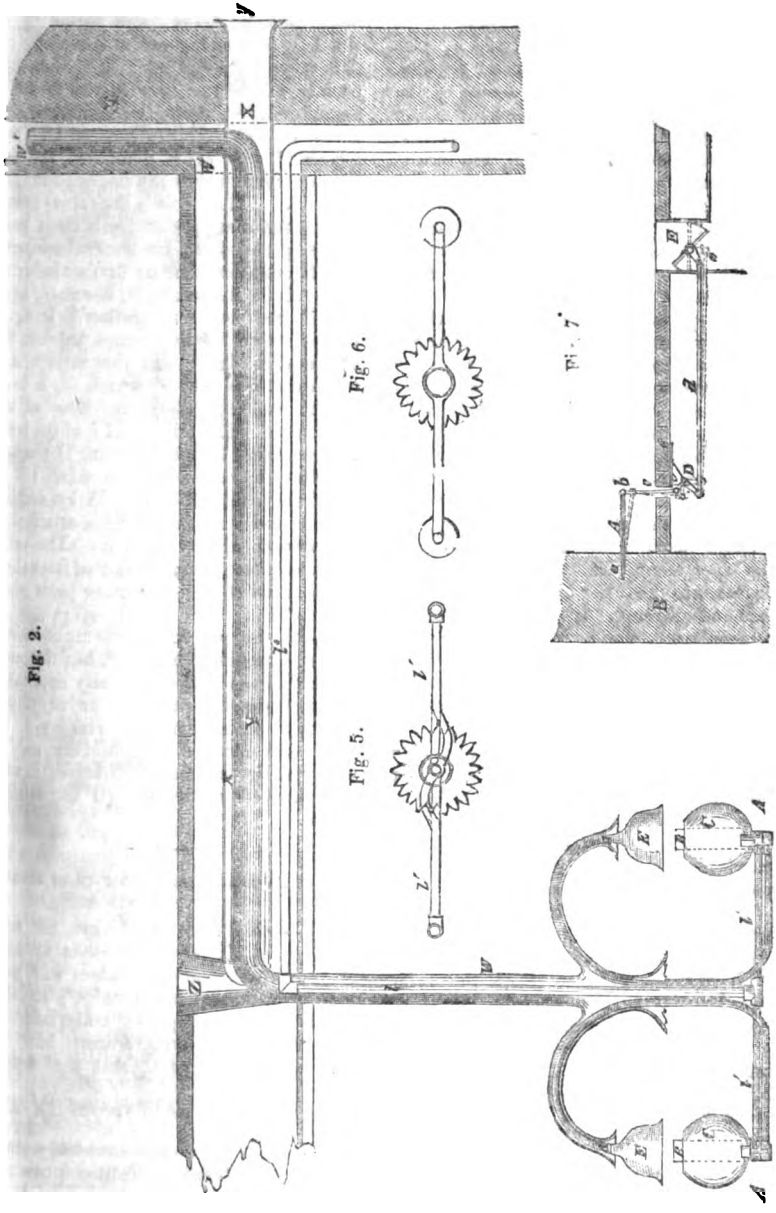
The invention which forms the subject of this patent consists in certain improved arrangements of mechanical and pneumatic means, either new in themselves or employed in a new state of combination, which have for their object, *firstly*, to render gas and other lamps self-preventive of noxious exhalations, or, in other words, to cause them to consume their own smoke and noxious exhalations: and, *secondly*, to effect the better heating and ventilating of buildings, apartments, and other confined places.

Fig. 1 of the accompanying engravings exemplifies the manner in which the first branch of the invention is to be carried into effect, by showing how it may be applied to, or embodied in, a gas lamp of one burner, suspended from the ceiling of a building or apartment. And fig. 2 is an exemplification of the manner in which both the first and second parts of the invention may be carried unitedly into effect, by showing their application to a pendent lamp of two, three, or any greater number of burners.

Each of these figs. (1 and 2) is a sectional elevation of the particular apparatus which it represents. A, fig. 1, is the burner; B, the chimney; and C, a globular shade. The burner A is separately represented, of its full size, in the two sectional views, figs. 3 and 4. It consists of three concentric tubes, *a*, *b*, *c*, which are respectively appropriated to the passage of the air, gas, and smoke. The innermost, or air tube *a*, terminates at bottom in a flange or ring, which is screwed or otherwise fastened to the two other tubes *b* and *c* (which are cast in one piece), as shown, and at top it is made of a bell-mouthed or other suitable form, so as to overlay to a considerable extent the top of the next adjacent or smoke tube *c*. The burner, with its chimney and shade, is kept suspended by means of two tubes, *d* and *e*, the under ends of which are connected to the burner, and the upper ends to a two-way piece D attached to the gas supply-pipe. The tube *d* serves for the supply of gas, communicating through the passage *f* of the two-way piece D with the gas main, and opening at bottom into the outermost tube of the burner, whence it flows to the apertures of ignition. E is a receiver or collector, which is suspended from the two-way piece D immediately over the chimney B, and communicates by a hollow shank with one end of the passage *g* of the piece D. The tube *e* is attached to the other or opposite end of the passage *g*, and serves to lead the smoke and noxious exhalations which collect in the glass E back to the burner, in order to be there consumed. The smoke and noxious exhalations being conducted into the central tube or compartment *c* of the burner, ascend till they encounter at top the overlaying part of the tube *a*, being deflected, by which they impinge against the flame, as indicated by the arrows at *h h*.

In fig. 2, M represents a portion of the side wall of a house or other building, and N a portion of the flooring and ceiling between two apartments of such house or building. L is a gas lamp suspended from the ceiling of the under apartment by means of a tubular pillar *l*, from the bottom of which two tubular arms l^1 l^1 branch off at right angles, each terminating in a burner A of the same construction as that before described, a chimney B, and shade C. The gas is supplied to the burners through the tubular pieces l l^1 l^1, the main piece *l* being connected at top to a feed-pipe l^2, which runs between the ceiling and floor, and communicates with a gas main in the usual manner. From the burners A A, and from the compartments of these burners (which compartments are not seen, however, in the figure now in course of description), two smoke pipes (*e e*) are carried upwards in the curved direction shown, and hold suspended from their beaks (immediately over the burners) two receivers E E, exactly similar to those employed in figs. 1 and 2, and before described. W W is an outer casing which encloses, but without touching, the greater part of the central tubular pillar *l*, and also the upper portions of the smoke pipe *e e*, each branch terminating at its lower end *a a* in a mouth-piece which immediately surrounds the neck of the smoke receiver E. The central branch of this outer casing is prolonged upwards through the ceiling, and there joined to a tube Y, which passes horizontally along under the floor of the

Digitized by Google



Digitized by Google

upper apartment and enters a vertical flue $W^1 W^1$, in the side wall of which it is carried to the top of the building, or any other convenient point of exit into the atmosphere. X X is an air passage, which is carried from the outside of the building at *y*, beneath the flooring of the upper apartment; it encloses in its progress the horizontal pipe Y, and terminates in an aperture *z*, which opens into the upper apartment. Figures 5 and 6 are plans of the outer casing W, and gas tubes *l* as seen from above. The gas, smoke, and other tubes are made of copper, iron, or tin, as usual.

The operation of the apparatus, which has been just described, in so far as regards the consumption of the smoke and other noxious exhalations arising from the burner, is precisely similar to that of the apparatus represented in fig. 1, but it is attended with this further advantage, that the greater part of the heat, which radiates from the gas and smoke tubes, and also all the lighter and more vitiated portions of the atmosphere of the apartment, are intercepted by or drawn into the outer casing W, and carried off through it into the external atmosphere, while in their progress through the horizontal pipe Y, they impart a degree of heat to the supply of fresh air flowing in through the surrounding pipe X X.

Where the apartment, or place to be lighted, has no connection with any other apartments or place, above or below it, requiring to be warmed or ventilated, as for example, the interior of a railway carriage, the cold air-pipe would of course be dispensed with.

The aperture *z*, which opens into the upper apartment in fig. 2, may be covered with a fixed perforated plate, as is usual with such apertures in floors and walls. Mr. Braithwaite regulates the flow of air by means of a throttle-valve or damper, acted upon by what he terms a "thermostatic lever," through the medium of or by wooden connecting-rods. The thermostatic lever is made as follows: "I take two slips of any metals possessing different degrees of expansibility, such, for instance, as iron and zinc, of about 15 ins. in length, 1 inch wide, and three-sixteenths of an inch thick, more or less, and connect them by soldering or rivetting them together face to face. I make this compound lever fast by inserting one end in the wall or brickwork of the building, and attach it by the other to a bell-crank or lever, and thence by a wooden connecting-rod to the spindle of the valve: the greater the heat the greater will be the curvature in the thermostatic lever, from the conflicting degrees of expansibility possessed by the metals of which it is composed, and the greater consequently the rise or opening of the valve. The valve is thus always most open when a supply of fresh air is most wanted; and when the general temperature falls so low that no further influx of fresh air is desirable, it becomes, as it should be, closed altogether. In fig. 7 I have shown the connection between the thermostatic lever and the valve. A is the lever, one end of which (*a*) is fixed in the wall B. C is the floor of the apartment. The other end *b* of the lever is connected to a bell-crank D beneath the floor, by means of a wooden rod *c*, and from the bell-crank D by another wooden rod *d* to the lever *e*, attached to the spindle of the valve E. The valve is represented open; the dotted lines show the position of the respective parts when closed."

In all the preceding exemplifications gas is supposed to be used, but the same arrangements will be equally applicable whether gas, oil, tallow, or any other combustible material is employed, or with such obvious modifications only as will readily suggest themselves to any workman of ordinary skill and intelligence.

REPLY TO MR. DREDGE ON IRON GIRDER BRIDGES.

Sir,—As I find that I have not misunderstood Mr. Dredge's *meaning*, most of your mathematical readers will have seen at once that Mr. Dredge's solution of the problem he has undertaken is quite wrong—(even granting him his own assumption, viz., that the weight borne by each of the two props is $\frac{1}{3}L\mu$.) inasmuch as he has unaccountably omitted all consideration of the pressures sustained by the abutments. The whole weight being $2L\mu$, if we even allow that the portion borne by the two props = $\frac{2}{3}L\mu$, there remains $\frac{4}{3}L\mu$ to be borne

Digitized by Google

by the two abutments, so that, if we substitute for P and Q in the value given in my last paper for M, the values $\frac{2}{3}L\mu$ for P and $\frac{1}{3}L\mu$ for Q, it becomes

$$M = L\left(\frac{2}{3}L\mu + \frac{1}{9}L\mu - \frac{L}{2}\right)$$

$$= L^2\mu \times \frac{5}{18}.$$

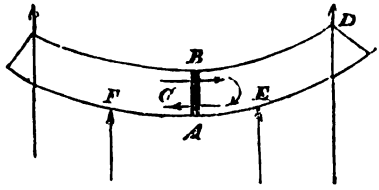
But, view it in whatever way we may, Mr. Dredge's reasoning will be found to be inconsistent even with itself; for, take the assumption that all the supports bear equal portions of the weight, then there being four of these supports, viz., the two props and the two abutments, each of these will bear $\frac{2L\mu}{4}$ or $\frac{L\mu}{2}$ instead of $\frac{L\mu}{3}$ as Mr. Dredge has got for each of the *props*. Indeed, he has (inadvertently I suppose) contradicted himself—for in his original investigation he says the pressure on each prop is $\frac{1}{3}L\mu$. (page 105, col. 1,) and in his reply he says "the reason I assumed $\frac{2}{3}L\mu$ to be the weight supported by each prop," thus making it double of what he had formerly assumed.

I need hardly say however to any mathematical reader, that such reasoning as that used by Mr. Dredge—even though it were consistent with itself — is altogether unsafe and unrecognised by any of the great writers on mechanics.

From Mr. Dredge's not making the slightest allusion, either in his original paper or in his reply, to the re-actions at the abutments, I am at a loss to understand what he supposes the abutments have to do, or whether they have anything at all to do with supporting the weight; because if they have, Mr. Dredge has never taken the slightest account of them (*i. e.* in taking the moment of the forces). In order that there may be not the slightest doubt left as to the mistake made in determining the value of the moment round the neutral axis—a mistake arising from entirely neglecting part of the acting forces (*as well as* making incorrect assumptions as to the rest), I will here give the mode in which this moment is obtained.

Let AB (fig. 1) be the section of fracture, C being a point in the neutral axis: each of the pressures at the abutments = P and each of the pressures sustained by the props = Q.

Fig. 1.



The fibres above C being in a state of compression, and consequently endeavouring to expand to their natural state, their action may be represented by a single force (since their directions may be considered nearly parallel when the deflection is small) whose direction is that of the upper arrow. Similarly the action of the extended fibres below C may be represented by a single force in the opposite direction as in the lower arrow. The combined effect of these two forces is to turn the right hand half of the beam, from B towards A round C, as represented by the curved arrow. Of course their effect on the other half of the beam to the left of C is just the opposite. The right hand half of the beam therefore is kept in equilibrium by the following forces: P at D and Q at E which are vertical, its own weight which = $L\mu$ and the elastic forces at C, whose moment round C we have called M. Consequently this moment must be exactly equal and contrary to that of the forces P and Q, whose distances from C are BD = L and AE = $\frac{1}{3}$L. and of the weight of the half beam acting at its middle. Hence is obtained the equation given in my former paper,

$$M = L\left(P + \frac{Q}{3} - \frac{L\mu}{2}\right).$$

To the question, then, why in forming his equation for the moment of the forces, be neglected to take any account of P, Mr. Dredge has returned no answer. If there were another force or pressure = R suppose acting at a distance (p) from

Digitized by Google

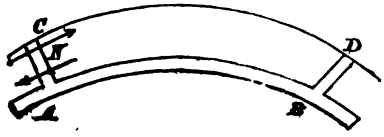
C vertically upwards, then the above value for M would become

$$M = L\left(P + \frac{Q}{3} + R\,\frac{p}{L} - \frac{L\mu}{2}\right).$$

And so on for any number of forces. I must apologize for occupying so much of your space on so very elementary and simple a process, but without doing so I could not point out where Mr. Dredge has erred.

With regard to the next question, perhaps the following mode of viewing it may assist the conception:

Fig. 2.



Suppose we take a bar, A B, Figure 2, connected by A C and B D, with another piece C D, and bend it with the hands into the position of the figure, is it not evident that A C and B D may be so thin and slight as to be incapable of transmitting the action to C D—in which case they will be the first parts to break. If so, it becomes simply a question—*how* strong ought these pieces to be made? Suppose N to be the neutral point in A C, the forces below N are tending to turn it one way and those above it the exactly contrary way: it is therefore obviously a question of relative strength whether A C will not snap in two from the small quantity of its material, sooner than A B or C D. Mr. Dredge says "the forces of tension and compression exist in the same line, the one neutralises the other, and it is only the excess of the tensile over the compressive force that would be acting on the bars A C or B D." Mr. Dredge might as well say that the forces of tension and compression "exist in the same line" in the beam or girder itself. In the beam these forces *do not* act in the *same line*: but in *parallel* lines. But in reality at any considerable distance from the centre of the beam I should think there was no appreciable extension or compression. I mean distance measured along the length of the beam. But when the only medium by which the action can be transmitted consists in the cohesion of the particles in so small a mass as that of A C or B D, it is not the compression or extension in these alone, which we have to consider, and which may be insignificant, but the aggregate of all the forces in A B or C D, which may be supposed to act in parallel directions, and which can only neutralise one another through the medium of the cohesive force of the particles in A C and B D: if this should be too weak, a fracture might occur in a direction *parallel* to A B or C D, or which is more probable, by the two parts turning round the point N.

The whole question however of the use of truss-rods when treated as a statical problem must necessarily be insufficient to supply any certain information as to what would happen when a weight—such as that of a railway train—comes *suddenly* on the bridge, for this action is of the nature of impact. From your last Number I perceive that Mr. Stephenson expects "from the relative weights of the tube and the trains," that there will be no vibration in his proposed Menai bridge. Without presuming to express any opinion as to the safety of this bridge—for which I do not believe we have any sufficient data—it is nevertheless perfectly certain that there must be vibration if the train comes upon it with anything like a rapid speed. Has Mr. Stephenson ever struck his hand against some iron railings? If so, he must have seen "how great a vibration a little blow causeth." I do not know what may be the opinions of the gentlemen by whom Mr. Stephenson has been assisted, but I think all opinions must be little better than mere guess-work which attempt to predict the *amount* of vibration.

Yours,

A. H.

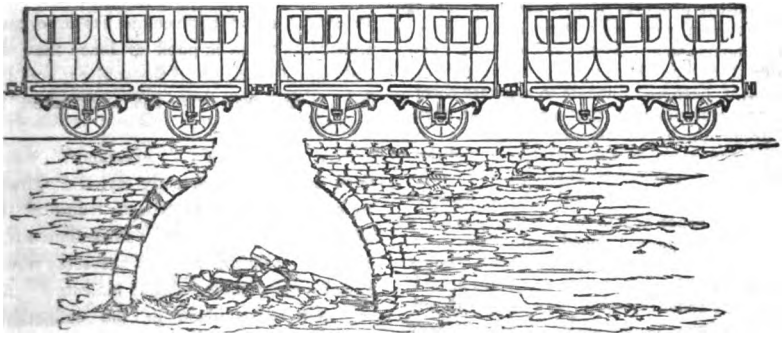
RAILWAY BUFFERS.

Sir,—Having been on a tour, I had not an earlier opportunity of seeing the contents of your monthly number of the *Mechanics' Magazine* for July, or I might sooner have noticed some of the observations that it contains respecting locked buffers.

The concave and convex buffers suggested by some one under the signature of "Cymro," in the *Times* of June the 15th, seems confined to meet the case of

Digitized by Google

buffers over-riding each other, as appears to have taken place in the accident at Wolverton, and would certainly tend considerably to produce that effect; but I had a further object in proposing the *locked* buffer, a term which will not apply to those merely denominated concave and convex. This will best be understood by the accompanying sketch (fig. 1), where a train with locked buffers is shown as passing over a ten feet chasm, made by the falling in of the crown of a bridge by the shock of the engine as it passed over it. In this case,



all the carriages but the last would go over without hinderance, as well as if the rail were not broken. The last carriage would have its front wheels safely deposited on the rail beyond the gap; but when its hind wheels come over it, the weight of the carriage operating upon its fore wheels as a fulcrum, will, from its leverage, more than outweigh the hinder part of the carriage in advance, and will lift it up, unless these carriages be loaded fore and aft alternately, or some other mechanical arrangement be made to meet this difficulty. The ordinary velocity of trains, aided by the weight of the hinder portion of the carriage in advance, may do much in most cases to remedy this defect; but if this prove all the objection to these locked buffers, it will not be difficult so to couple the last carriage in a train, and perhaps even the engine in front, with the others, as to enable them to pass over such a chasm, though it may have been made previous to the arrival of the train. For broken wheels and axles, these buffers are a perfect cure.

I have not yet seen Mr. Sutton's letter of June 26th, 1845, published in the *Sun* newspaper, and therefore I cannot speak as to his views respecting buffers; but I can only say that I am much more anxious to get this locked-buffer system *adopted*, than to claim being either first, second, or third in this invention, which has, I am confident, through many stages yet unseen, to become one of the main safeguards in the history of railway travelling.

I am, Sir, yours, &c.,
GEORGE CAYLEY.

20, Hertford-street, August 28th, 1847.

(*To be continued.*)

PROFESSOR SCHOENBEIN'S IMPROVEMENTS IN PAPER.

Extract of a Letter from M. Schoenbein to M. Dumas, dated March 28, 1846.

The author has discovered a method by means of which the following properties may be given to the paper in common use:—

1. Prepared paper has much more tenacity and greater consistency than common paper.

2. When dipped into water it does not lose its consistency, but is affected as parchment would be.

3. It receives with equal facility both writing and printing ink.

4. It does not require sizing to render it suitable either for writing or printing.

5. The injurious effects produced by the chloride of lime are avoided in prepared paper.

M. Schoenbein states that his process is simple, inexpensive, and easy of application, and that the new paper offers many

Digitized by Google

advantages, particularly for bank notes and for paper hangings.

The vegetable fibre of this paper renders it possible to make of it a substance as transparent as glass, and impermeable to water. The author has made of it bottles, balloons, &c., the sides of which may be made as thin as a plate of mica.

Another property of this paper is, that it developes a very energetic electric force. By placing some sheets on each other, and simply rubbing them once or twice with the hand, it becomes difficult to separate them. If this experiment is performed in the dark, a great number of distinct flashes may be perceived between the separated surfaces. The disc of the electrophorus, placed on a sheet that has been rubbed, produces sparks of some inches in length. A thin and very dry sheet of paper, placed against the wall, will adhere strongly to it for several hours if the hand is passed only once over it. If the same sheet is passed between the thumb and forefinger in the dark, a luminous band will be visible. Hence, it is believed, that this prepared paper will answer to make powerful and cheap electrical machines.

PROFESSOR DONALDSON'S ARCHITECTURAL MAXIMS.*

Mathematics has its axioms, natural philosophy its "Principia;" but architecture is without anything of the sort. "All," says Professor Donaldson, "who have studied architecture in the works of its masters will have observed, that, although all treat of the principles which govern the art, they seldom attempt to lay down clear and definite rules couched in simple terms. The laws are not expressed in an axiomatic form, or in a series of distinct propositions." Mr. Donaldson has thought it might be "useful to the professional man to make an attempt" to "reduce some of the canons of the art to the forms of theorems briefly expressed," and hence the work before us.

Whether it is, because architecture is an art which does not admit of the axiomatic precision desiderated by the professor, or that there is no common agreement amongst mankind as to any of its principles, we will not stop to inquire; but certain it is that anything less axiomatic or *maximatic* than the work before us could hardly have been penned. The fact that a gentleman of Professor Donaldson's acknowledged talent and erudition should have failed so completely, as in our judgment he has done, may perhaps be taken as good evidence that the fault is in the nature of the subject, and not in the professor who has undertaken to handle it.

Mr. Donaldson's "Maxims" would have been more correctly styled "Observations, Original and Select;" and if the word "Desultory," or "Miscellaneous," had been prefixed, the true character would have been still more clearly indicated. All are well worth place in the collection; for though but few can be considered as of the rank of established truths, they are all at least exceedingly suggestive of useful reflection. Indeed, so little have they in general the character of "Maxims" that we cannot fix on more than a dozen or so which are not more or less questionable, either for unsoundness or uncertainty. Let us take a few specimens at random.

"V.

"* * * There *can* be only three orders of classical architecture and no more."

Why? Because "there are three principal gradations in all objects; thus in nature there are the tall, the short, and the mean between the two; the strong, the weak, and the mean between the two." Because there are also "three primitive colours"—three "degress of comparison"—and (*risum teneatis*) because "the crust of the earth is mainly composed of three materials,—silex, argil, lime!!!"

What any of these harmonic triads, or any other triads whatever, have to do with the number of orders of which classical architecture is suceptible, it would puzzle an Œdipus himself to discover. There is no common principle of relationship whatever between them.

Why not *five* as well? For has not man,

* Architectural Maxims and Theorems in Elucidation of some of the Principles of Design and Construction, &c.; and a Lecture on the Education and Character of the Architect. By Thomas Leverton Donaldson, M.I.B.A., Professor of Architecture in University College, &c., London, 1847. 8vo. pp. 105. Weale.

Digitized by Google

the very *beau ideal* of organic construction, five fingers, and five toes, and five senses, &c., &c.

Or *seven?* Because there are seven stages in man's life, seven days in the week, seven notes in the gamut, seven champions of Christendom, seven hills in Rome, &c., &c.

The "*can* be" of the Maxim is the more startling, that in point of fact ancient or classical architecture was divided by the ancients themselves into *five* orders, the Corinthian, the Composite, the Ionic, the Doric, and the Tuscan. Mr. Donaldson indeed tells us, that the "Tuscan is but a simplification of the Doric, and the Composite, an amplification of the Corinthian—modifications, not distinct ideas." Be it so; yet are they orders as distinguishable from the others as 1 from 2, or 2 from 5.

"VII.

"The three Classic Orders contain all the fundamental principles of the æsthetics of Classical Architecture; but architecture comprehends *more* than the three orders."

How are we to reconcile this with the "can be" of Maxim V. If ancient architecture could have no more orders than three, why is not modern architecture in the same category? What principle of beauty or fitness is there which could be true in the time of Pericles, and yet false in the age of Victoria? We have always understood that such principles were of all time—everlasting and immutable.

"XLVII.

"Each edifice, having its peculiar appropriation, demands that the impress of its distinctive character should be visible in its aspect. The imposing and solemn temple—the splendid and commanding regal palace—the embellished residence of the noble—the gloomy prison—the cheerful theatre—should immediately announce their purpose and destination. If not, where is expression in architecture?"

"Where," indeed? Yet, here we see the professor himself recognizes five distinctive styles as being requisite to "expression in architecture," to say nothing of several others which might readily be suggested. What then becomes of the "classical" three, which, according to a previous "maxim," embraced everything essential? And what of the professor's notable reasons for it—the "silex, argil, and lime" reasons, more especially?

"CXXIV.

"Strength sufficient (for the immediate purpose) is not strong enough; therefore, it is better to have too much solidity than too little."

Interpreted literally, this means that "strength sufficient," is *not* strength sufficient. The reader can readily guess at the better meaning which is hid under this oracular verbiage; but what that better meaning is, he only learns from the two other "maxims" which follow.

"CXXVI.

"No wall nor framing, nor, in fact, any piece of construction, ought to be charged with more than two-thirds of the load which it is calculated to bear. On railroads, where the load is variable, and concussion takes place, the law is one-third."

"CXXIX.

"It is not the *fracturing* weight which is required in practice, but that weight which will not injure the material."

The three "maxims" last cited, taken together, make good enough sense; but is it not a poor maxim which requires the help of two others to make it intelligible?

Of the better things in the collection—though with as little pretension as may to the character of "canons of the Art," the following may serve as specimens:

"XVII.

"The works of the ancients were founded upon the finest perception of fitness; yet the rules, which guided them, are not insuperably binding on the moderns. 'To look back to antiquity is one thing, to go back to it is another,' says Colton. And how full of truth is Bacon's sentence on the same point!—'Antiquity deserveth that reverence, that men should make a stand thereupon, and discover what is the best way; but when the discovery is well taken, then to make progression.'—*Advancement of Learning.*

"XLIX.

"How fine and striking is the description of a private residence given by Wotton at the commencement of his 2nd part!—

Digitized by Google

'Every man's proper mansion-house and home is the theatre of his hospitality, the seat of selfe-fruition, the comfortablest part of his own life, the noblest of his sonne's inheritance, a kind of private princedome. Nay, to the possessor thereof, an epitomie of the whole world.'

"LXIII.

"The eye of the ignorant or vulgar cannot appreciate many of the nice '*nuances*' essential to beauty. Woods, with his usual penetration, observes, that 'It is quite a mistake to suppose that a variation of form, not immediately perceptible to the eye, must therefore be useless. Every artist has felt, that these slight changes influence the charm of the composition without being themselves obvious even to a skilful observer.'* (vol. i. p. 337.)

"LXIV.

"If a difference of size in parts or details exist in a building, and be not discoverable unless one takes a compass, a rule, a square, or a level, they are no longer defects. Buildings are not made for measurement, but delight. When these discrepancies escape the eye, and minute examination can alone detect the irregularity, the beauty of the whole does not cease to affect us. In the Pantheon the angular columns are anti-Vitruvian, being smaller, instead of larger, than the others. At the top of the pediment there is a double modillion; and on one side of the sloping cornice twenty-four modillions, on the other twenty-two. 'Bravo,' says Milizia, 'to him who has counted them; but più-bravo to him who turns up his nose at such microscopic criticism.'

"LXXVII.

"The life of an architect is one of continual reasoning: no two buildings, which he may be called upon to design or contemplate, can be precisely alike. It requires therefore an exquisite susceptibility, unwearied patience, and sound judgment to know in what respects they differ, and how the necessary difference should be, or has been, satisfied."

"The following are of the exceptional class—the 'few and far between,' strictly axiomatic, just, and true:

"L.

"All voids and solids should be on their respective axes throughout: in plan for beauty—in elevation for strength.

"LXXVI.

"It should be the purpose of the architect to allow no day to pass without adding a sketch to his collection. His motto should be with Titus: 'Nulla dies sine linea.' 'For there cannot be a more baneful error,' observes George Moore, 'associated with initiation into art, than the dangerous dogma, that the aspirations of genius need not be trammelled by the labour of study.' (p. 35.)

"LXXXII.

"To be a good architect one must be a good designer: but a good designer is not necessarily a good architect. Vitruvius distinctly says: 'Architecti scientia nascitur ex fabricâ et ratiocinatione.' (b. i. c. l.)

"LXXXVI.

"He cannot improve in his art, who is not conscious that he is far from perfection. 'I am diffident,' said the celebrated James Watt, 'because I am seldom certain that I am in the right, and because I pay respect to the opinions of others, where I think they merit it.'"

To the "Maxims" there is added the substance of a Lecture delivered by Professor Donaldson to the pupils of the University College "On the Education and Character of the Architect." The "Lecture" will do more, we apprehend, than the "Maxims" to uphold the Professor's high reputation, both as a practitioner and teacher. It abounds in noble sentiments, always forcibly, and often happily expressed. With a few specimens from this part of the book, we must conclude:

Advantage of Literature to the Architect.

"A general acquaintance with literature is useful to the Architect, on account of the necessity he will frequently have of explaining his ideas by words and writing. To accomplish this with method, clearness, facility, and even brilliancy, is a desirable, but not a common attainment.

"Vitruvius does not suggest to the Architect the gift of oratory, thinking perhaps that the eloquence of the Architect consists rather in his works than his words. In fact, Plutarch relates of two Architects, who offered themselves to the people of Athens in order to gain the superintendence or execution of some public works, that one of them, more expert than the other in the art of speaking, enchanted the Athenians by the brilliancy of his address. The other having remained silent, at last said, "I, sirs, will do what he has said."

Uses of Biography.

"Biography is a most attractive and, from its moral influence upon the mind, a very important branch of history. It teaches us the course, by which great men have at-

* As in the entasis and convexities of Greek Architecture.

Digitized by Google

tained to eminence. It unveils some of the arts, by which incompetent men have acquired a passing reputation. It shows the trials, through which most must pass, ere they may hope to excel. It marks the influence, which our art has had through all periods and among all nations. It hands down to us the noble and high-minded characters of those, who have graced our profession; the generous sacrifices of which they have been capable; their forbearance and disregard of low motives; their disinterestedness. Michael Angelo, in order to preserve his independence, declined the stipend attached to his appointment as architect of St. Peter's. And one of the Florentine architects, being sent by the Grand Duke of Tuscany to Naples, where he executed some fine works for the King, declined any gratuity, saying that he had a generous prince by whose liberality he was already amply rewarded. The King would not be denied, and earnestly begged him to name any object he would like. 'Give me then,' said he, 'that antique statue, that I may present it to my prince, as a gift worthy of his acceptance and a suitable mark of my affectionate attachment to a generous master.' Let me refer you to Milizia's *Lives of the Architects*, translated by Mrs. Cressy, and believe me, that you will always rise from the perusal of those well-written memoirs with a greater love for your profession, a nobler passion for glory, a greater disregard of gain."

Theory without Practice.

"There is another class of study essentially important to the young Architect, and that is *Practice*. He may have acquired all the principles which govern science. He may have studied monuments, learnt the rules of proportion, and made himself thoroughly acquainted with the whole sphere of art. But, unless he be also versed in the practical details, it would be dangerous to himself and fatal to his employer, if he undertook a building of any importance. He has a conscientious duty to perform: not only to design well, but to execute the work in the soundest manner and with the least cost. Young men, carried away by the enthusiasm to which the fascinating attraction of the art of drawing gives rise, find it irksome to enter into the details of construction, the cost of materials, measuring and valuation. But if an Architect wishes to possess all the means, by which he may realize his conceptions, he must go through this ordeal, he must visit and study works in progress: and when he becomes better acquainted with the subject, he will find a growing interest in the pursuit. There is no moment of his life, at which the true Architect ceases to study and acquire knowledge: and no source is too despicable for him to gain information. The labouring artisan has many mechanical contrivances, by which he may accomplish his task and execute his work. From him the Architect, whether as a student or as the more advanced practitioner, may learn much. In fact we must not only be satisfied that a thing is done, but know how it is done; and eagerly avail ourselves of the knowledge of the workman. By not being ashamed of asking questions at any period of our career, we gain their respect and win their confidence. How many a young man is there, who leaves an office without any acquaintance with these departments of the profession! He commences business thus inadequately prepared. His very first commission involves him in inextricable difficulties. He is at the mercy of the builder, the workmen, and all employed. A sense of his ignorance in this respect preys on his mind. He resolves to devote his energies to make himself thoroughly versed in the practical details of construction, and he passes years and years devoted to this; and thus employs time, which, had he been better trained, could have been more beneficially and honourably appropriated. He had still to learn his profession!!"

Architects and Employers.

"There are many trying circumstances which will arise in regard to the relations of the Architect to his employer. He is of course to consult his convenience, to adapt the building to his reasonable fancy, and above all to take care that it exceed not his circumstances. At the same time, when once the design is settled, he must not allow a meddling interference with the details, nor permit a man of fanciful ideas to force him to do what is contrary to good taste, and likely to compromise the character of the Architect: for he will in the end have to answer for everything that may be wrong. He must be firm, but also respectful; and being otherwise irreproachable will create a feeling of deference and consideration for his professional acquirements. We know that we owe the Pavilion at Brighton and Buckingham Palace to the low taste of George the Fourth, who insisted upon his architects building according to his whims and fancies. The consequence has been, that they deservedly bear all the blame. Had they assumed a high-minded independence, and declined to undertake a work disreputable to their rank in the profession, it is possible that their firmness might have produced conviction on the mind of the Prince, and saved them from the obloquy, which they acquired,"

Digitized by Google

TILKE'S NATIONAL ECONOMIC BATH.

[Registered under the Act for the Protection of Articles of Utility.]

Fig. 1.

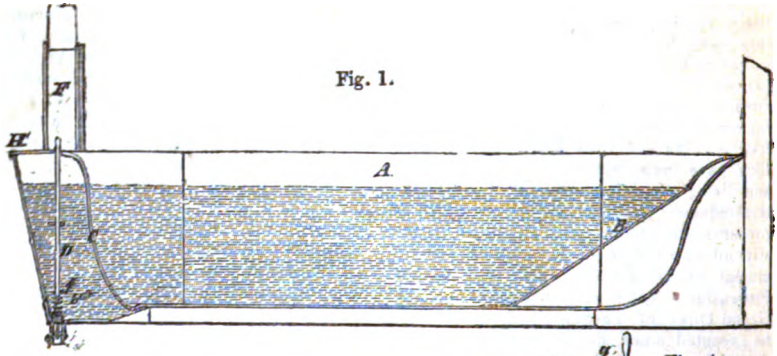


Fig. 2.

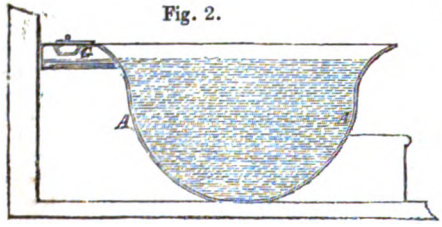


Fig. 3.

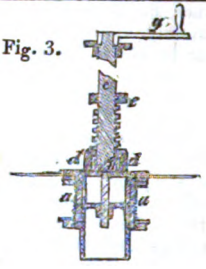


Fig. 4.

Mr. Tilke, the inventor of this extremely well-contrived apparatus, is the well-known attentive and obliging superintendent of the National Economic Baths, Holborn.

Fig. 1 is a sectional elevation, and fig. 2 a cross section of the apparatus. A is the body of the bath; it is made of a single piece of metal reaching from one edge to the other. B is the head of it, which is inclined, to form a suitable resting posture for the back of the bather. C is the foot of the bath; on the outside, but connected therewith, is a separate chamber D, opening through C by a number of perforations at the lower end. E^1, E^2, E^3 are three valves, placed in the bottom of the chamber D—two of them for the admission of water, hot and cold, and the other for the escape of the waste water. Fig. 3 is a section of one of the valves; *a a* is the valve-seat, which is fixed upon the bottom of the chamber D; *b*, the valve; *c*, the spindle, connected to the valve disc by a nut *d*; *e* is another nut, which is let into a cross-piece *f*, fixed to the sides of the chamber D; and *g* a crank-handle, by which the valve is screwed up or down upon its seat. F is a small door, by which the bather can communicate with the attendant outside, whose duty it is to turn on and off the water, as desired, as also to regulate its temperature, which he does by immersing a thermometer in the water in the chamber D, by lifting the lid *h*. Fig. 4 is a plan of the top of the chamber D. G is a water-tight box for heating towels in; it is immersed into a small chamber communicating with the water in the bath.

MESSRS. DEANE, DRAY, AND DEANE'S GRAIN, SPICE, AND SEED-CLEANSER, SIFTER, AND POLISHER.

[Registered under the Act for the Protection of Articles of Utility.]

Fig. 1 is a side elevation of this apparatus; fig. 2, an end elevation; and fig. 3 a plan. A A is a framework of wood, within which a perforated metal cylinder B is fixed, in an inclined position, the angle of inclination being shifted at pleasure to suit the quantity of seed to be cleaned. In the plan (fig. 3), the upper

Digitized by Google

Fig. 1.

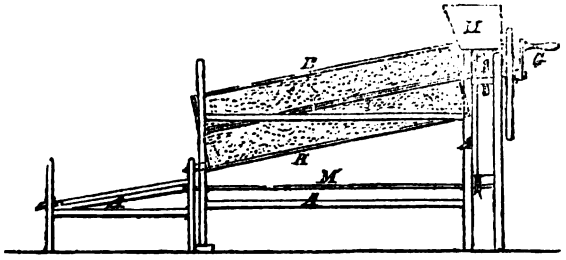


Fig. 2.

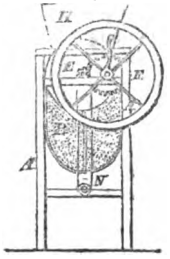


Fig. 3.

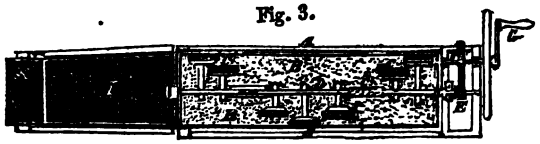
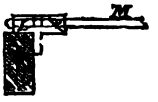


Fig. 4.



half of the cylinder is removed, to show the arrangements inside. C C are a series of brushes, placed upon the shaft D in a spiral direction, so that they follow the line that would be occupied by the helix of a screw of the same pitch. E is a pinion upon an intermediate shaft, the end of which shaft takes into a coupling in the end of the shaft D. F is a wheel gearing into E, through which motion is given to the revolving brushes by the crank-handle G, fixed upon the fly-wheel shaft. H is a hopper, into which the grain, seed, &c., to be cleaned and polished, is placed. I is a sifter, into which the seed runs after having been cleansed from dust, &c., by the action of the brushes. This sifter derives a peculiar shaking motion from the action of a spring K, which causes it to have a constant tendency towards the end of the cylinder B, and a revolving inclined plane L, placed upon the end of the spindle M. The inclined plane is shown on an enlarged scale in fig. 4. N is a band, by which the spindle M is made to revolve.

ASHENHURST'S IMPROVED FOLDING MUSIC AND READING DESK, OR EASEL.

[Registered under the Act for the Protection of Articles of Utility. John Talbot Ashenhurst, of 41, Upper John-street, Fitzroy-square, Proprietor.]

Fig. 1.

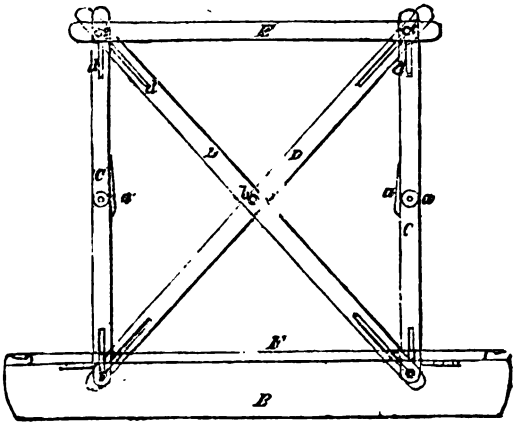


Fig. 2.

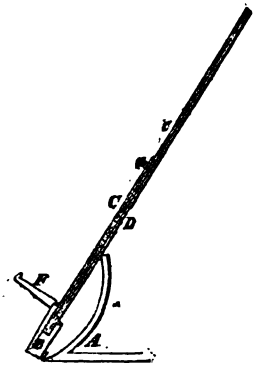


Fig. 1 is a front elevation of this desk in its expanded state, and fig. 2 an end elevation of it. A is part of a musical instrument or table, with the basement

Digitized by Google

of the folding desk B attached to it. C C are the side rails of the frame, which are jointed at *a a*. D D are diagonal rails, also jointed at *b*. E is the top rail, to which the ends of the side rails C C, as also the diagonal pieces D D, are connected, by pins *e e* passing through the slots *d d d*. The connexions of the side and diagonal rails with the basement B are effected in a similar manner. F is the rest, which is hinged to B with stop-hinges. When the desk is not in use, it is folded up by depressing the top rail, which causes the two side rails to bend inwards at the central joinings *a a*. The sliding of the pins *e e* within the slots *d d* admits of the whole of the framework folding so close together as to be hid by the rest F when it is folded over.

The superiority of this music desk over those of the ordinary construction will be appreciated at a glance. It is expanded and folded up with the greatest facility, and occupies no greater *length* of space in the one state than in the other.

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

(Continued from page 200.)

I shall draw this series of papers to a conclusion by a few miscellaneous observations. And, in the first place, I shall revert to a remark previously made with regard to one source of confusion and mystification perhaps more productive of embarrassment to the student than any other, namely, the total want of any clear and distinct notions as to what the symbols used in mathematical treatises on Mechanics really mean. It is a long while generally before he gets any intelligible views of the real nature of the reasoning: long, even, before he sees clearly what is meant by the "measure of a force," and how forces are measured. At the risk, then, of some repetition, I will take a few examples illustrative of what is here alluded to. Suppose the following sentence to be met with: "The attraction of the moon on the earth $\frac{\mu}{r^2}$ at the distance r." Now, this is a short way of expressing what, in plain English, will be a very roundabout affair. In the first place, the signification of the Greek letter (μ) will be generally explained by the author to be, "the attraction of the unit of mass at the unit of distance;" but we must go still further, and explain more fully. Now, the word "attraction" is, it must be confessed, an ambiguous one to the non-mathematical reader of it (and such the beginner, of course, is), and is often used in different senses, which naturally leads to the beginner's using it with no sense at all.

It is here used with reference, not to the act of attracting, manner, mode, power, or anything else of attracting, but simply to denote and stand for *a certain number*, namely, the number of feet which the attracted mass passes over in a certain time, namely, in one second—which it is usually said to pass over or "describe" "*in consequence of* that attraction:" a good specimen of those combinations of words which convey no earthly information whatever. As to what this motion of the attracted body is "the consequence of," no human being knows, and no mathematician cares. Whether it be the man in the moon himself tugging away at an invisible rope, or whether the moon be a permanent magnet, or an electro-magnet,—in short, make any conceivable supposition you like; but don't imagine that any one of them has the remotest possible connection with the "mathematical" lunar theory. This number, viz., the number of feet over which the attracted body moves during the first second of its moving from a state of rest, or (which is more convenient when the body attracted already is in motion) the *velocity* produced in it at the end of one second—that is, *added* to what it had before, (and which velocity itself is again measured by the number of feet over which the body would move in one second,)—this *number*, I say, is the "measure" of the "moon's attraction," or of the moon's "accelerating force," and is itself often called "the accelerating force," whereas, properly speaking, it is "the acceleration." Now, of course, this acceleration depends upon the mass of the attracting body, and upon the distance between the attracted body and it. Newton's law, or

Digitized by Google

the connection between all these quantities, which he, having first *guessed* or *supposed might be* true, afterwards verified by finding that all the motions of the moon and planets were in numerical accordance with that supposition—this "law" is, that the acceleration mentioned is greater just *in proportion as* the attracting mass is greater, and is *less* just *in proportion as* the square of the distance between the two bodies is greater. This law is expressed algebraically thus:—Suppose that "the attraction of" a mass M produces in a given body, and after having acted upon it for one second, the velocity A (A being the number of feet which, in consequence of that velocity, the body would pass over in the next second after, if the attraction were to cease to act), the distance between the two bodies being (R) feet; and suppose that, by the attraction of another mass (m) on the same body, the velocity B is produced in one second, the distance between these two bodies being (r)

$$\text{Then,} \quad A : B :: \frac{M}{R^2} : \frac{m}{r^2},$$

$$\text{or} \quad \frac{A}{B} = \frac{M}{m} \cdot \frac{r^2}{R^2}.$$

It is perfectly optional with us what mass we choose to consider as the standard or "unit" with which to compare others. Let then the mass of the earth be taken as that "unit": and suppose we take its radius as the unit of distance in the above equation where we may consider M as the mass of the earth, R its radius, and A the velocity produced by the earth's attraction in one second. Putting then M and R each equal to unity, we have for B, the value

$$B = A. \frac{m}{r^2};$$

or, if we prefer, according to the usual notation to denote the "attraction" for "acceleration" produced by the unit of mass at the unit of distance, by the Greek letter (μ), we arrive at the equation B = acceleration produced by the moon whose mass is (m) on the earth, $= m.\frac{\mu}{r^2}$.

Thus then, if we choose, as we have done, our unit of mass and distance, the symbol (μ) signifies 32.2 feet.

Precisely in the same way may the plain meaning of all such equations be got at; and the student should always be able to translate into common English (though most likely very awkward and longwinded sentences) all the equations he uses. In Statics, he must get out of the habit of considering the letters P, Q, &c., as representing the dirty pieces of brass and iron which he sees in shops—and learn to look upon them as simple *numbers* (of *pounds*, or *ounces*, or any other unit) which *measure* the *pressures* or *weights*. It is these *numbers* or *ratios* which are *represented* by the straight lines in the Parallelogram of Forces, &c.: the *number* of units of length (of inches for instance) in a line A P having the same ratio to the number of inches in the line A Q which the number of units of pressure (one pound for instance) in the pressure P has to the number of units of pounds in the pressure Q.

As another instance of a very common misconception, let us take the series

$$\cos\theta = 1 - \frac{\theta^2}{1.2} + \frac{\theta^4}{1.2.3.4} - \&c.$$

$$\sin\theta = \theta - \frac{\theta^3}{1.2.3} + \frac{\theta^5}{1.2.3.4.5} - \&c.$$

Now to many students, who are not altogether without thinking what they are about, and yet have not attained to clear notions on the distinction between *things themselves* and the *numerical measures* of those things—the above series are a sad stumbling-block, and well they may be. The reader who has these misty notions, naturally asks—"How can a sine or cosine, which I know to be a number or ratio, be expressed in terms of *an angle*, which I conceive to be an *opening*?" How indeed! About the *ne plus ultra* of all conceivable absurdities would be the following equation;

$$\text{sine of a certain opening} = \text{that opening} - \frac{1}{6}\,(\text{cube of that opening}) + \&c.$$

The absurdity arises from considering the symbol (θ) as standing for the Euclidian angle or opening, instead of for a certain numerical fraction or ratio which *measures* that angle and which bears the same proportion to *other frac-*

Digitized by Google

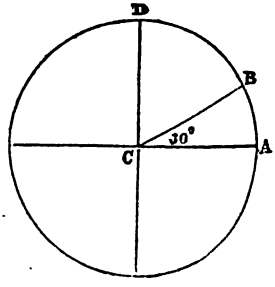
tions (the measures of other angles), which the Euclidian angles themselves do. Cos. θ is really an abridgment for "cosine of that Euclidian angle the length of whose arc bears the same proportion to the length of the radius, as the number θ does to unity."

Again the *use* of these series is seldom seen, and because the series on the left hand side of the equation is infinite in the number of its terms, the student is apt sometimes to conceive that an immense number of those terms must be taken to get anything like a tolerably near value for cos θ or sin θ. To obviate this fancy, and at the same time to show clearly the real nature of the equation, let us take a numerical example and work it out. Suppose then, we endeavour to find the numerical value of the cosine of 30 degrees by means of the series. Here (θ) means

$$\frac{\text{length of arc subtending the angle of } 30^\circ}{\text{length of radius.}}$$

and this is the first thing to find.

Now, we know that the length of the circumference of a circle bears the proportion to its diameter of (π) to unity: π being nearly equal to 3.1416. We have then,



$$\frac{\text{arc AB}}{\text{arc AD}} = \frac{30^\circ}{90^\circ} = \frac{1}{3}.$$

$$\therefore \text{arc AB} = \frac{1}{3} \times \text{arc AD} = \frac{1}{3} \times \text{a quarter of the circumference.}$$

$$= \frac{\text{semi-circumference}}{6},$$

$$\therefore \frac{\text{arc AB}}{\text{radius}} = \frac{1}{6} \cdot \frac{\text{semi-circumference}}{\text{radius}} = \frac{1}{6}\pi = \frac{3.1416}{6}$$

so that here (θ) is equal to .5236.

Take only the first three terms of the series for cos θ, so that

$$\cos 30^\circ = 1 - \frac{1}{2}(.5236)^2 + \frac{1}{24}(.5236)^4.$$

Keep only four places of decimals in multiplying, and the second side becomes $= 1 - 0.137078 + 0.003130 = .866052$.

Now turn to a table of natural sines, &c., and you will find the cosine of 30° to be ·8660254, which agrees with that just found from the series up to the fifth place of decimals, and differs less from it than the cosines of 30°. 1′, or 29°. 59′, differ from the cosine of 30°.

Again reminding him that all the symbols used to denote forces, angles, &c., &c., are nothing but simple, harmless *numbers*, or numerical ratios, and no such bugbears as he fancies—and that the fewer of such misty beings he conjures up the better—I take leave of this part of the subject, hoping it may be of some service.

(*To be continued.*)

THE "GREAT BRITAIN" AFLOAT!

The "possible" event of our last week's statement has actually come to pass. The *Great Britain* is afloat! We quote the following accounts from the *Times*. The first appears to have been communicated by a Dundrum Bay (perhaps Hibernian) correspondent:

"This immense vessel, which has lain stranded at the head of the fatal Bay of Dundrum since September last, is now once

Digitized by Google

more safe in dock at Liverpool. Her rescue is one of the greatest triumphs of engineering talent, as applied to the raising of a stranded ship, upon record—not even excepting the floating of the *Gorgon* steam-frigate, at Monte Video.

* * * *

"It is known that during the springs of last month, the gigantic ship, under the directions of Mr. Bremner, of Wick, to whom the operations for floating her had subsequently been intrusted, was raised entirely out of the sand, in which her keel had been imbedded, by means of great caissons, or 'camels,' as they are termed by shipbuilders, suspended over rows of piles driven into the beach from the vessel's bow to a point about midships, and descending, by means of chains and blocks, as the tide rose and the steamer floated. The actual impulse was given by powerful levers, acting on fulcra under the bilges, and worked by capstans and other purchases on the vessel's deck. All these appliances, however, had been cleared away previous to the tide of Wednesday night last (25th August), preparatory to the final attempt to remove the vessel from the shore, where, for upwards of a month past, she had been resting upon two ridges of stones under the bilges, which permitted the workmen effectually to repair her bottom.

"On the flowing of the tide on Wednesday night, floating operations were commenced, by means of anchors laid out astern, and the warps attached to which were hove upon by the vessel's windlasses and capstans. These were so far successful as to move the ship about three fathoms farther to seaward, in which position she was permitted to remain until the following day. The *Birkenhead*, iron steam-frigate, of 1,400 tons, and 600 horse power, had come down from Kingstown early in the week to act as a tug when required; and the *Scourge*, steam-bomb ship, of 400 horse power, which had formed one of the royal squadron in her Majesty's excursion to Scotland, had also been despatched to the Bay of Dundrum, and anchored about a mile and a half to the south-eastward of her stranded sister. A large number of the crews of those two steamers were aboard the *Great Britain*, and very efficiently contributed to the success of the experiment. Mr. Bellamy, Second Master-Superintendent of Portsmouth Dockyard, and a strong detachment of riggers from the dockyards both of Portsmouth and Plymouth, were also on board the *Great Britain*, and rendered good service.

"On Thursday recourse was had to the steam power of the *Birkenhead*, but, owing to the failure of the floating apparatus in two large lighters alongside the *Great Britain*, and to the lowness of the tide, which, owing to a northerly wind, which had prevailed for some days, did not rise so high as had been expected, all the efforts made to remove the vessel were entirely unsuccessful, she not having been towed out even one foot.

"On Friday, at the flowing of the tide, about twenty minutes before noon, the final experiment to float off the ship was made, and, we have the highest satisfaction in stating, was attended with the most complete success. Two 'best bowers' had been laid out a cable's length astern, and, in addition to these, two strong warps had been spliced to those of the *Birkenhead*. By heaving on these, the mammoth steamer was towed out to seaward upwards of eighty fathoms, and into snug moorings. The ship, everything considered, made very little water—not, we should say, more than six inches an hour—a leakage which was easily kept under by ten out of the forty pumps which had been provided to meet any possible emergency, and some of which were of the most powerful description.

"LIVERPOOL, MONDAY, 3 P.M.

"At half-past 1 o'clock this day the *Great Britain* arrived in this port from Belfast, at which place she arrived from Dundrum Bay on Friday afternoon. *** She was brought down the river opposite to the George's pier-head, where the *Birkenhead* left her, and went into the Cobourg Dock. Immediately on the *Birkenhead* leaving her, the *Great Britain* was taken by the steam-tug into the Prince's Dock Bason, and placed on the "gridiron." Her masts, rigging, &c., looked much worn from long exposure to the weather, but the general appearance of the noble ship was much better than could have been expected. With few exceptions, the upper part of her hull does not seem to have sustained much damage. On the larboard beam there were a few indentations in the iron frame-work, some of which were cut entirely through, and in the neighbourhood of the bow might be seen in two or three places similar marks of damage. She seemed to be making a considerable quantity of water, but the admirable working of the pumps was quite sufficient to counteract that evil.

"We learn that it is intended immediately to put her into a thorough state of repair, after which, we presume, she will again cross the Atlantic."

Of the ability of the Dundrum Bay correspondent to pass a judgment on the value of the "triumph" thus achieved, an opinion may be formed from the utter ignorance he

Digitized by Google

displays of the means actually employed. There were *no* "great caissons, or *camels*, as they are termed by shipbuilders," used to float the vessel off; and our specific ground of complaint against the salvors is that none were employed. The great caissons referred to were the great boxes *filled with sand*, which differ just as much from camels as a balloon does from a coal barge. From first to last nothing but sheer force has been employed—nothing but what might have been as readily had recourse to eleven months ago as now; and again we repeat, that whatever may have been the nautical skill shown in working the purchases (for which we presume the seamen and dockyard riggers must be allowed the principal credit) it is "not by means of any (engineering) ingenuity, or science, which the Messrs. Bremner have brought to bear on the task" that the ship has been saved. To say that her rescue is "one of the greatest triumphs of engineering talent" is simply absurd. Of "engineering" there has been none at all—not a vestige; and of "talent" of any sort, as little as may be.

RECENT AMERICAN PATENTS.

[Selected from Mr. Kaeler's Abstracts in the *Franklin Journal* for June.]

IMPROVEMENTS IN THE PLOUGH. *John M. May.*

Claim.—"What I claim as my invention is making the land-side, the bed of the share, and the standard, all in one piece of sheet metal, cut out in the manner described, so as to afford greater stability, and to reduce the cost of construction.

"I also claim making the coulter with two points and two cutting edges, and secured to the land-side of the standard, to admit of reversing end for end, and inclining the forward point up or down, for the purpose and in the manner described.

"And, finally, I claim connecting the axletree of the guide-wheels with the beam, by means of adjustable arms, to afford a means of directing the plough, as described."

IMPROVEMENT IN WINDMILLS. *Allen Judd.*—This invention consists in placing the vanes around a vertical shaft, and at distance therefrom, and arranged with their planes tangential to the inner circumference of the rims of the wheel to which they are attached, or to some circle of less diameter, with sufficient space between each for the passage of the wind, which enters the wheel from below, and acts on the inner surfaces of all the vanes and passes out; the wheel being surrounded with two series of shutters, or blinds, one series below a floor, which is on a level with the lower open rim of the wheel, and the other series above this floor, the former being thrown open on the side towards the wind, by which it enters the wheel, and those of the upper story thrown open on the other side, for the escape of the wind after it has acted on the wheel.

IMPROVED APPARATUS FOR WASHING AND AMALGAMATING GOLD AND SILVER. *Daniel Asbury.*—The patentee says,—"By the ordinary and common processes for the separation of gold and silver from their ores, by washing with water and amalgamation with mercury, there has always been a loss of both gold and silver, as well as of the mercury. In the hand rocker and long semicircular trough, usually worked by hand, the quantity of sand and gravel which these machines can work is small, consequently, when that contains but little gold or platinum, it cannot be worked with profit; and in these machines there is a great loss of both gold and platinum, as well as quicksilver (when that is used), because the motion is half the time in one direction, and half the time in the other, by which the gold, &c., is prevented from subsiding, and consequently passes off with the water and sand. In the Burke rocker, there is a still greater waste of quicksilver and the precious metals. In the Tyrolese bowls, the sand and gravel subside too soon to the bottom, and prevent the contact of the gold and silver with the quicksilver. My machine, I believe, will obviate all these practical evils, which heretofore have attended the extraction of the precious metals from their ores, or earthy and stony mixtures; these objects I effect in the following way:

"The moving frame, which supports the pans, is hung to two cranks on two shafts, one at each end, by the rotation of which the required shaking motion, such as would be given by hand, is obtained."

IMPROVEMENT IN THE METHOD OF TUNING THE METALLIC REEDS OF SERAPHINAS, ACCORDEONS, &c. *J. Shaler Ives.*—The patentee says,—"The object of my improvement is to simplify and cheapen the construction, and to provide means for the adjustment of the reeds, to make them "speak;" these ends I attain by making the reeds, which are attached to the bottom of their appropriate plates, to spring up through the apertures in which they vibrate, so that by the application of an adjustable

Digitized by Google

pressure above them, their plane can be regulated relatively to the apertures with the greatest nicety, to insure their speaking and giving out the best tones, the vibration being insured for a good tone by the pressure of the spring of the reed against the presser."

Claim.—"What I claim as my invention is tuning metallic reeds that vibrate within the apertures for the passage of the wind, by means of adjustable pressers that act against the spring of the reeds, substantially as described.

"I also claim making the slide with the parallel spring bars or branches, substantially as described, to insure the working of the slide without being affected by the vibration of the reed, as described.

"And I also claim making the pressure on the top of the reed by an adjusting screw, or other analogous device, to regulate the speaking of the reed, as described."

A "CLOTH MOTH HARBOUR," FOR PROTECTING BEES FROM THE MOTH, *Daniel Arndt.*—This consists of an apartment lined with cloth, which the moth enters, and in which it remains (attracted by the warmth of the cloth), instead of passing into the hive.

Claim.—"What I claim as new, and as my invention and discovery, in the above-described apparatus, is the cloth moth harbour for protecting the bees and their labours from the ravages of the moth; the moth being induced, through the warmth of the cloth lining, to deposit its eggs therein, instead of in the hive."

METHOD OF PROPELLING BOATS, RAILROAD CARS, &c. *Josephus Echols.*—The patentee says,—"The object contemplated by me in this invention is to economize the power required for propelling boats, or other vessels, by making use of the resistance which the water presents to the bow of the boat in its passage, and causing it (the water) when being deflected, to turn a wheel which is in connection with the paddle-wheel shaft, and thus assist the driving power, such as a steam-engine in propelling the boat. With the view to attain this end, extra water wheels have been placed at the sides of the vessels, and connected with the paddle wheels, so that the current of water set in motion by the paddle wheels should communicate motion to the extra wheels, which, by the connection, transfer the power to the paddle wheels; but it must be obvious that this arrangement occasions an actual loss of power, for the motion communicated to the extra wheels at the sides retards the boat by a force equal to that communicated to them, minus the friction. But by placing the compensating wheel at the bow, where the water must be displaced by the bow of the boat, the deflection of the water communicates available power to the wheel, which may be advantageously employed to aid in the propulsion of the boat, or applied to any other purpose."

FOR A MACHINE FOR SHAVING AND JOINTING STAVES FOR BARRELS, &c. *Jno. H. Lester.*—The patentee says:—"The dressing and jointing on rived stays by machinery, are operations which have heretofore presented much difficulty, and of the various attempts to attain these important ends, by means of rotating planes, none has, so far as I am informed, been successful. The difficulty arises from the fact of the uneven and crooked condition of the rived bolts, which must be dressed with the grain of the wood, and of equal thickness, and the necessity of jointing the curved edges of the staves, to give the bulge to the barrel, or cask, by a continuous movement. The dressing of staves has been essayed by two rotating planes—one to plane or dress the concave, and the other the convex surface; the planes being placed one forward of the other, so that the staves pass from the one to the other: but in this there is no method by which the planes can adapt themselves to the bends and crooks of the bolts. Attempts have also been made to joint the edges with rotating planes, by placing the stave, after being dressed, on a reciprocating carriage, provided with guides to cause the rotating planes to approach towards and recede from each other, to give the required bulge to the staves.

"The improvements which I have made, remove these difficulties, and consist, first, in hanging the two rotating planes, one above the other, in a vertically sliding frame, to receive the bolt from the feeding or guide and pressure rollers, and pass them to other rollers, which deliver or conduct them to the jointing operation, the frames sliding up and down, to adapt the planes to the bends or crooks of the bolts, the sliding of this frame being effected by two sets of rollers hung in the frame, one forward and the other back, of the rotating planes; and, second, in giving to the frames in which the jointing cutter heads are hung and run, reciprocating movements towards and from each other, by means of cam-grooves, eccentrics, cranks, or other analogous device, as the staves are fed forward by a positive motion; the continuous feeding and reciprocating motion of the cutter heads being made to correspond."

FOR IMPROVEMENTS IN RAILROAD SWITCHES. *Philos B. Tyler.*—The patentee says:—"The nature of my invention consists in constructing the movable part of

Digitized by Google

the switch with an additional branch rail, between which and the true switch there is an inclined plane, and a guard on the outside, so that when the switch is set wrong, the cars cannot run off the track."

IMPROVEMENT IN THE MANNER OF APPLYING WATER TO WATER-WHEELS. *J. K. Millard.*—This is for a mode of regulating the discharge of water on to that class of water-wheels formerly known as "tub-wheels," but now sometimes called "turbine wheels." The flume, which is vertical, has a bottom just above the top of the wheels, and in this there is an annular opening corresponding with the circle of the buckets of the wheel. In this groove are hinged a series of shutters, which are suspended to a ring, which, when let down, covers entirely the annular aperture, so that, when this is raised or lowered, the shutters are opened or closed, and therefore the general aperture is regulated in proportion to the separate apertures formed by the series of shutters.

Claim.—"What I claim as my invention is the arrangement of the series of shutters to regulate and direct the discharge of the water on to the buckets of the wheel, in combination with the gate to which they are suspended, and by which they are operated and protected from the too violent action of the water; this gate at the same time affording a better means of shutting off the water than could be effected practically by the shutters, as described."

IMPROVEMENTS IN REVERBERATORY FURNACES FOR SMELTING IRON. *Andrew Ellicott and John M'Crove.*—This is for an improvement in furnaces for reducing iron ores, whose object is to facilitate and economize fuel. Two stacks are placed side by side, with a blast for each, which, as occasion requires, may be diverted in such a manner that nearly the whole blast may be directed to one of the stacks, while the charge in the other preserves sufficient heat for its stage of the process."

FOR IMPROVEMENTS IN THE PROCESS FOR MANUFACTURING IRON DIRECTLY FROM THE ORE, AND IN THE APPARATUS THEREFOR. *J. F. Winslow.*—The patentee says,—"My improved process is applicable to the treatment of oxides of iron only; and this I effect in reverberatory furnaces, although some parts of the process may be applied in furnaces without the reverberatory feature.

"It has long been essayed to reduce the oxides of iron directly into the metallic state by heating the ores mixed with carbonaceous matter, with the view to produce deoxidation, and then to transfer the mass thus treated to the puddling process; but in all these, which have so far been unsuccessful, the upper stratum only of the mass of ore and carbon was exposed to the direct action of the heat and flame, instead of the whole mass; and to avoid this evil, it has been suggested to apply heat to the mass of ore and carbon below as well as above, by placing the fire grate directly under the furnace hearth, or floor, and then reverberating the flame and passing it over the charge. This modification, while it removes the leading objection of the process above indicated, introduces practical difficulties of such magnitude as to defeat the contemplated object.

"My improvements effectually avoid these difficulties, and consist in exposing the mass of pulverised ore, mixed with carbonaceous matter to the combined action of a gentle flame, or heat; and currents of heated air passing through the mass, which, in their passage, not only agitate the mass to aid the mechanical liberation of the gasses evolved, but aid in evolving the gases from the oxide and carbon, which, in their nascent state, combine and revive the metallic particles.

"The mass is then subjected to the combined action of a more intense flame, and to highly heated currents of carburetted hydrogen gas, that pass through the mass and take up the remaining oxygen of the ore, and revive the metallic particles; and then the mass passes to the puddling process, where it is subjected to a still more intense heat, and to the action of jets of highly heated atmospheric air, to consume the carbonaceous matter, and free it from other impurities. For the application of my improved process, I have made important modifications in the well-known reverberatory furnace, which, for this purpose, is made of much greater length than those heretofore used."

FOR IMPROVEMENTS IN THE JACQUARD FRAME, FOR WEAVING FIGURED FABRICS. *John Perrins.*—The patentee says,—"In the jacquard frame, as heretofore made and now used, the trap boards, through which the tail cords pass, and by which they are lifted, are each operated by separate levers, thus requiring as many levers and separate operations as there are trap boards; and in the mode of mounting to form the harness as at present practised, each division of the tail cords (all that pass through one trap board I will call a division) is in connection with one colour only (it will be understood that when I speak of one colour only, I mean also the threads connected with the mails of one pair of lifters), and that, as a necessary consequence, when the threads of one colour (or combination of colours in a pair of lifters) are to be used to interweave the picks, the cards must be shifted and a new card presented for each pick.

"The object of my improvement is to

Digitized by Google

simplify the structure and operation; first, by connecting all the trap boards, by horizontal slides, with a vertically sliding frame, operated by one single lever, so that all the trap boards are lifted together, the lifting of the tail cords being governed by the sliding of the trap boards, that are provided with notched holes through which the cords pass, so that when the trap boards are shifted (which is done by cams on a rotating shaft, turned by the sliding of the trap board frame, or any other intermitting movement), the knots on the tail cords, which have been shifted by the needles, are caught and lifted; and, secondly, by connecting the tail cords that pass through one trap board with the mails on two different pairs of levers, so that the mails of each lifter of one colour, or one set of colours, are connected with two trap boards, and so of the other colours. The advantage of this arrangement is, that one card only is required for each lash, as the interweaving of one colour can be effected by one card, in consequence of the connection of the mails of each lifter of one colour, each with two separate trap boards; while, by the old plan, it is necessary to shift the needles to interweave the same colour, as the shifting of the threads of one colour can only be done by shifting the needles by a change of cards, in consequence of the connection of all the mails of one colour, or one set of colours, with one trap board."

For Improvements in the Machine for Cutting the Threads of Wood Screws. *Thos. W. Harvey.*—The patentee says:—"The nature of my invention consists, first, in arranging the screw blanks in a continuous row, when thrown promiscuously into a hopper, and delivering them, one by one, without the necessity of an attendant, which is effected by means of two inclined rollers, placed far enough apart to permit the shanks of the screws to hang vertically between them, so that, by their rotation and inclination, they cause the blanks to arrange themselves side by side, with the heads resting on, and the shanks hanging between them, and thus gradually to force them towards the delivery end.

"My second improvement consists in taking the blanks from the ends of the rollers, and delivering them into a vertical conveying tube, by means of a slide, which has an aperture in it that admits the blank, and by its motion, and the oblique side of the aperture, forces it, horizontally, and in a vertical position, to the aperture of the delivery tube, down which it descends, at the same time checking the further descent of the blanks between the rollers until its return, the aperture being so formed as to permit the descent of the blanks into it from the rollers before the repetition of the delivery operation.

"My third improvement consists of a pair of spring conveying fingers, which are presented to the lower end of the vertical tubes down which the blanks descend, and slightly opened by coming in contact with a projection from the lower end thereof to receive the end of the blank as it descends, and which is griped by the fingers as they are moved away; the conveying fingers projecting from a shaft, so operated by a slide and a series of cams and levers, that it rotates through a part of a circle to bring the blank in a horizontal position, and then horizontally to present the head of the blank to the gripers, preparatory to cutting the threads.

"My fourth improvement relates to the employment of gripers joined to a chuck or head, at the end of a hollow mandrel, and connected to one end of a sliding rod within the mandrel, the other end being connected with a slide governed by a cam, the sliding of which causes the gripers to take hold of the blank just within the head, to rotate it whilst under the operation of the chasing tool, when this is used in combination with a turn-screw, that slides within or on the sliding-rod, and forced towards the head of the screws by a spring, so that if the blank should turn in the gripers, in consequence of the bite in the chasing or threading tool, the turn-screw will be forced into the nick in the head, and there hold it.

"My fifth improvement relates to the arrangement of the thread cutter or chaser, and the sliding rest, the latter of which is secured to a sliding chasing frame or carriage, for the purpose of preventing the shanks of the screw from yielding while under the action of the chaser; which latter is also properly secured in an adjustable tool-holder or head, jointed by its lower end to the chasing sliding frame, the upper end sliding on a rod secured to a sway bar, one end of which is jointed to an adjusting slide, and the other governed by a cam which gives the requisite taper and point to the screw. The chasing frame is governed in its motion by a chasing cam groove on a cylinder, the groove being so formed as to move the chasing slide to carry the cutter gradually from the commencement of the thread towards the point, with a motion so regulated relatively to the rotation of the mandrel, as to give the pitch of the thread, and then moved back again for another cut, one part of the groove crossing the other for this purpose; and that part of the groove which moves the chasing slide for chasing the thread is in the form of a helix, and at

Digitized by Google

the end thereof it crosses the helix with a sudden curve to run back the chaser, and at the end of the helix the groove runs into another groove, the junction of these two being provided with a sliding switch, connected with a sliding rod within the chasing cam shaft, and so governed by another cam, called the index cam, that when the thread is chased the switch is shifted, which opens this latter groove to draw the chasing frame and chaser far enough out of the way to admit of the operation of the conveying fingers to supply a new blank.

"My sixth improvement relates to the method of adjusting the motions of the chaser to the varying lengths of blanks, and to the different form of points, so as to insure the formation of good points on the screws, by making the cam which governs the motions of the sway-bar adjustable on its shaft.

"And my last improvement relates to the mode of changing the cams that operate the conveying fingers—the griping cam and the chasing cam—by means of an index cam, which operates sliding twitches, through the intervention of sliding rods, within the hollow mandrel and the cam shafts.

"By means of these improvements I constitute an automatic machine, which performs all the operations of arranging the blanks in regular order, supplying them one by one, conveying them to the gripers, chasing the thread with any desired taper and point, and discharging the chased screw, with no other human labour than is necessary to keep the mechanism in order, and to throw a large quantity of blanks into the hopper at given intervals."

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 213.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

James Rumsey, of Falcon-stairs, Southwark, engineer: of new and improved certain methods of applying the power of steam and water, either together or separate, as circumstances may require, to the purpose of milling, and giving advantageous motion and effects to all kinds of machines and engines upon which they may be brought to act: consisting of the following heads: 1. In constructing these water wheels in general of metal with their cuckets or floats movable upon hinges, &c., &c. 2. In improving the common wheel, where the fall of water is small and low, by causing the rims and cuckets of the wheels, which should be well leathered and lined within, to move in a case or apron of metal or wood that closely embraces its lower part, &c., &c. 3. In constructing water wheels, with their cuckets or floats fixed upon the extremities of flat metal rings, mounted upon horizontal axes, moving through a slit in a circular tube facing the centre or axis of the wheel, while its cuckets, which are leathered, pass through the tube itself, &c. 4. In causing the ends of specifier's improved "Barker's tube water mill" (specified pursuant to patent of 24th March, 1790) to move round with its ends in a circular case that is open next the axis of the tube which extends on contrary sides of each end to the bottom of the case, &c. 5. In removing obstruction to wheels arising from back water occasioned by floods or tides, &c. 6. In giving powerful motion and effects by the agency of steam to specifier's new invented and improved water wheels by fixing the wheels within tight vessels immersed in water, and keeping the said vessels exhausted by a steam engine of the water, &c. 7. In giving powerful motion and effects to various machines by causing specifier's new-invented steam engines (hereafter described) to be fixed horizontally with piston rods, passing through one or both ends of their cylinders, in order that it may work different machines at the same time or alternately. 8. In giving powerful motion and effects to mills and other machines by causing specifier's forcing steam engine (specified pursuant to the said patent of March, 1790) and the atmosphere alternately to force pistons with water back and forwards in cylinders fixed horizontally or otherwise, &c. 9. In giving powerful rotary motion to specifier's said water wheels by means of a steam engine applied to force water into an air vessel, from which it is conducted by a tube or otherwise to act on the wheel of a mill, &c. 10. In giving powerful circular motion to specifier's new-invented rotary steam and water engines that are applicable immediately in all directions to every machine requiring circular motion of a uniform power of any given strength, without the encumbrance or necessity of cocks, valves, slides, or gates, except to stop or put them in motion, &c. 11. In giving powerful circular motion by specifier's new-invented horizontal rotary steam engine, which in its form is not much unlike the old Barker's mill, as described in several philosophical works, the steam from the boiler being made to enter the top of an upright tube of metal that becomes the axis

Digitized by Google

of the machine, which is applicable to any purpose requiring circular motion, &c. 12. New-invented steam engines for lifting, forcing, or dispersing water, and other purposes. 13. In improving, by more fully explaining, the principles, constructions, and applications of specifier's boilers, steam vessels, &c., described in the specification of his patent of Nov. 6, 1788. Cl. R., 31 Geo. 3, p. 6, No. 7. Aug. 25, 31 Geo. 3; Sept. 24, 31 Geo. 3, 1791.

(To be continued.)

LIST OF ENGLISH PATENTS GRANTED ON SEPTEMBER 2, 1847.

William Sykes Ward, of Leeds, York, gent., for improvements in communicating motive power, which are applicable to working signals and breaks on railways, and also improvements in communicating intelligence, signals, and motive power by the agency of voltaic electricity. six months; September 2.

Richard Madigan, of Haverstock-hill, Middlesex, civil engineer, for certain improvements in railway turn tables. Six months; Sept. 2.

Charles Chabot, of Skinner-street, Snow-hill, zincographer and engraver, for improvements in railway carriages and in the buffers and other apparatus connected with such carriages, Six months; Sept. 2.

Henry Davy, of Ossery Saint Mary, Devon, gent., for improvements for separating copper and other metals from their ores. Six months; Sept. 2.

Thomas Foster, Streatham, Surrey, manufacturer, for improvements in machinery for cutting India rubber, in rendering fabrics waterproof, and in making articles from fabrics so rendered waterproof. Six months; Sept. 2.

Robert Oxland, of Plymouth, chemist, for improvements in dyeing, parts of which improvements are applicable to the manufacture of metallic alloys. Six months; Sept. 2.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Aug. 27	1179	George Curling Hope,	Ramsgate	Tambour and crotchet needle.
,,	1180	George Curling Hope,	Ramsgate	Knitting and crotchet cotton.
,,	1181	John Patterson	Wood-street, Cheapside	Belt fastening.
30	1182	Abram and Charles Seward	Lancaster	Hot air furnace for warming buildings.
Sept. 1	1183	William Smith	Gresham-street	Tray for holding pins and needles.
,,	1184	Jacob Lyons	Wilson-street	The Royal Cambridge Coa.

Advertisements.

Viaducts and other Railway Work.

THE attention of Railway Engineers, Architects, and Contractors is particularly directed to the great advantages to be derived from the application of SEYSSEL ASPHALTE, as the *only impervious and permanent* covering for arches and roofs, and lining of reservoirs, gutters, &c. The arrangements of CLARIDGE'S PATENT ASPHALTE COMPANY enable it to execute works of any extent with the greatest promptitude.

In order to guard against the use of spurious materials, it is important that all applications for works to be executed be made direct to this Company; and, as a further protection, it is suggested that Engineers, Architects, and Contractors should require a CERTIFICATE from the Company that the proper description of material has been used.

Information may be obtained as to all works which have been executed by the Company since its establishment in 1838, which will prove that the failure of many works represented to have been done with the genuine material has resulted from the substitution of a spurious one.

I. FARRELL, Secretary,
Seyssel Asphalte Company, Stangate, London.

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings, and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Patent Bells.

MESSRS. MEARS beg to call the attention of the Trade and the Public generally to these articles, which they are now prepared to supply in any quantity and variety. The composition is of a new metal, called the Union Metal, and the bells are of very beautiful tone, and cheaper than those made of the ordinary bell metal. Orders received at the Bell Foundry, Whitechapel, for house, cattle, and other bells.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, he EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are, that they are cool, light, and impervious to oil or grease. thus combining the desiderata so long sought for by the public.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

CONTENTS OF THIS NUMBER.

Description of Mr. Braithwaite's Patent Improvements in Heating, Lighting, and Ventilating—(*with engravings*) 217
Reply to Mr. Dredge on Iron Girder Bridges. By A. H. 220
On Railway Buffers. By Sir George Cayley, Bart. 222
Professor Schoenbein's Improvements in Paper 225
Professor Donaldson's "Architectural Maxims" —(Review) 226
Description of Tilke's National Economic Stove —(*with engravings*) 228
Description of Messrs. Deane, Dray, and Deane's Grain, Spice, and Seed-Cleanser, Sifter, and Polisher—(*with engraving*) 230
Description of Ashenhurst's Folding Music and Reading Desk, or Easel—(*with engravings*) 230
Remarks on the Use of Mathematical Knowledge to Engineers, and Hints to those who have not the Benefit of a Tutor—(*continued*) 230
The "Great Britain"—Afloat! 233
Recent American Patents—Abstracts of Specifications 234
Calendar of Specifications—(*continued*) 238
Weekly List of New English Patents. 239
Weekly List of Articles of Utility Registered. 239
Advertisements 239

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 165, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

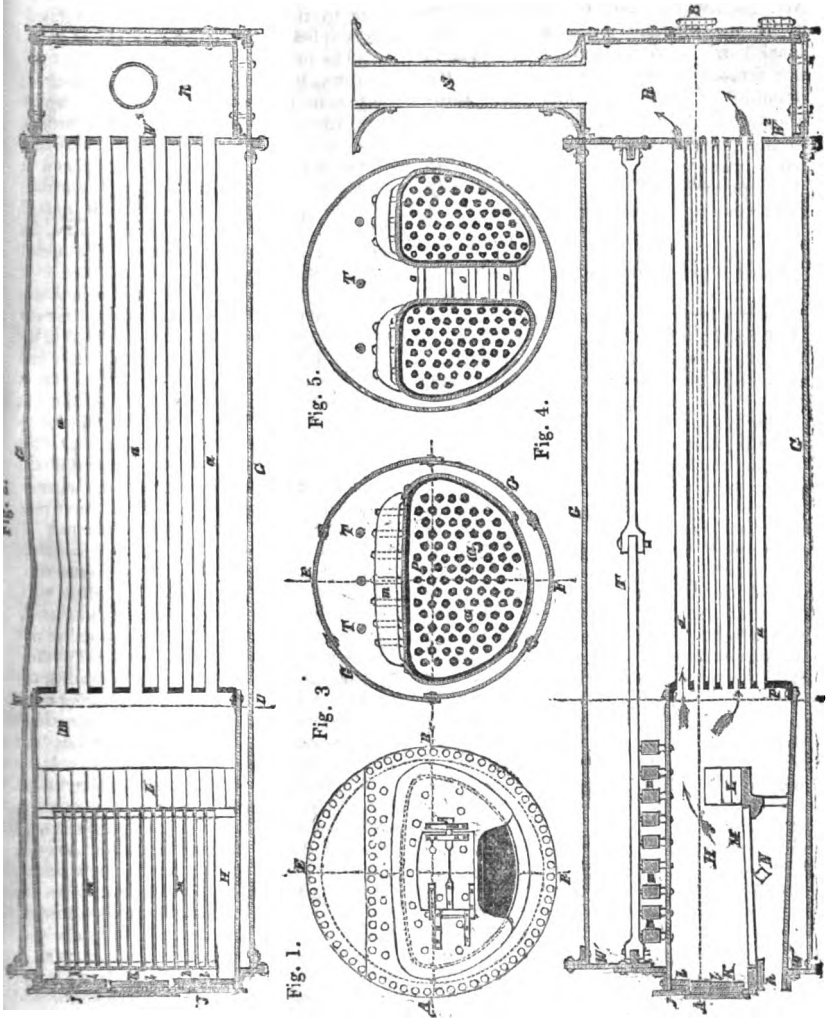
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1257.] SATURDAY, SEPTEMBER 11. [Price 3*d*.

Edited by J. C. Robertson, 166 Fleet-street.

MESSRS. FOSSICK, HACKWORTH, AND ELLIOTT'S PATENT IMPROVEMENTS IN LOCOMOTIVE BOILERS.



Digitized by Google

MESSRS. FOSSICK, HACKWORTH, AND ELLIOTT'S PATENT IMPROVEMENTS IN LOCOMOTIVE AND OTHER TUBULAR BOILERS.

[Patent dated March 3, 1847. Specification enrolled August 3, 1847.]

THE accompanying engravings, figs. 1, 2, 3, 4, represent a locomotive boiler constructed according to the improvements which form the subject of the present patent. The advantages attending these improvements will be found stated in the course of the description; and are such as will command—if not instant assent—at least universal attention. Mr. Hackworth, one of the patentees, is, if we mistake not, the same Mr. Hackworth who figured in the lists at the famous Prize Competition, on the opening of the Liverpool and Manchester Railway; and if so, he brings to his present task a more than ordinary share of practical experience in the department of engine work to which the following specification relates:

Description.

Figure 1 is a front elevation of the boiler; figure 2 a sectional plan on the line A B; figure 3 a transverse section on the line C D of fig. 2; and fig. 4 a vertical longitudinal section on the line E F. G is the external shell of the boiler; W^1 the front plate, and W^2 the back plate (exclusive of the smoke-box); H is the fire tube, or box, which is made of a semicircular form, with the exception only that it is slightly convex at the top, as shown. It may be made either of copper or iron plates, and riveted either with copper or iron rivets, and the plates may be of any length, width, or thickness judged best. J J is the front plate of the fire-box; K the doorway. Both the front plate and the doorway are lined with double plates (*l l*) in order to protect them from the fire. L is the fire bridge. M M are the fire-bars, which rest at the near end on a slab plate *k k*, and at the far end on a ledge projecting from the bottom of the bridge. N (fig. 4) is a transverse bearing on which the fire-bars rest at the middle of their length. The furnace is riveted at top to a series of transverse iron stays *n n*, which are made of wrought iron, and may vary in number according to the degree of pressure to which the boiler is intended to be subjected. P is a thick plate, at the inner, or far end of the fire-box, and of the same nearly semi-cylindrical form, which has a flange turned out of itself all round, by means of which it is riveted to the other furnace-plates (flange inside). In this plate are a number of holes, in which are inserted the near ends of the fire tubes *a a*, which pass through the body of the boiler, and are inserted at their other extremities in the back plate W^2. R is the smoke-box; S the chimney. The whole of the fire-box is made steam-tight, and the space all round between it and the external shell G is filled with water, and communicates with the other water spaces of the boiler. T T are a series of wrought iron stays which are passed lengthways from the front plate to the back plate of the boiler, and are coupled in the middle as shown in fig. 4. The fire-tubes *a a* are arranged in vertical rows, so as to leave a free passage from bottom to top between the rows. And as these rows, in consequence of the semicircular form of the fire-box, are necessarily of varying lengths, they are so placed in respect of one another that every tube shall have an open water space on both sides of it. By this arrangement of the tubes, the water, as it is heated, is enabled to ascend more freely between the tubes than in a boiler, with tubes arranged in the ordinary zig-zag manner; while at the same time any solid matters which may be separated in the course of the conversion of the water into steam, have a freer descent to the bottom of the boiler. When, again, it is required to cleanse the boiler, this is readily effected by passing straight rods down between the straight rows of tubes to the bottom of the boiler, and stirring up the deposits which are then carried off by washing. These rods may have short radial flexible scrapers of whalebone, cane, or other suitable material, attached to them, in order to cleanse also the tubes in passing; but in boilers with tubes arranged in the order herein directed, the deposit in the tubes is so small as not for a long time to affect materially their heating power, whereas in boilers with the tubes arranged in the ordinary zig-zag manner, the tubes become very rapidly incrusted, lose as rapidly their heating power, and soon cease to be of any use.

Where boilers of very large dimensions are required, a modification of the arrangement just described, such as is represented in fig. 5 of the drawings annexed, may be adopted. This modification consists simply in parting the fire-box and tubes down the middle into two distinct sections, and in employing two furnaces, one to each section. The sections are placed at such a distance from one another as to leave a water space between them, and they are connected together sideways by strong stays *o, o, o*. Each section is constructed in all other

Digitized by Google

respects in the same way as the single fire-box and tubes hereinbefore described.

Fig. 6.

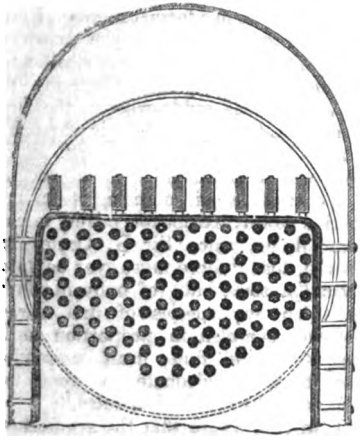
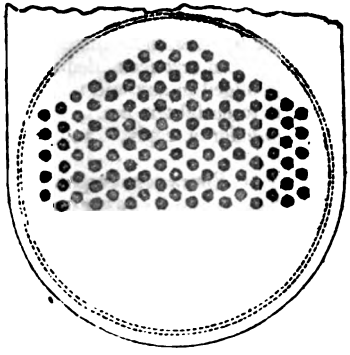


Fig. 7.



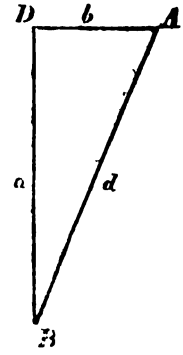
Should it be desired to adapt the tubular arrangement before described to locomotive boilers of the ordinary rectangular description, this may be done in the manner exemplified in fig. 6 and fig. 7, the former being a sectional elevation of the fire-box end of a boiler, with the tubes adjusted according to our plan; and the latter, a sectional elevation of the same at the smoke-box end.

Boilers, with the improvements before described—all or any of them—may be applied either to locomotive, or to marine, or to stationary boilers.

AERIAL NAVIGATION.

Sir,—Since inditing my answer to Mr. MacGregor, I have been induced to doubt whether the objections he made to my Archimedean Balloon were indeed "true in principle." In Sir G. Cayley's "Practical Remarks on Aërial Navigation," in the *Mechanics' Magazine* for March 4th, 1837, No. 708, I find the learned baronet demonstrating the erroneous nature of the supposition "that any propelling force of waftage, when acting in the direction of the *car*, will not tend to propel the *balloon* above it;" and Sir George proves, that when the propelling power is exerted horizontally, the cords by which the car is suspended, will bend back to a certain *limited* extent only, and this extent need not be great. Thus, in the triangle A D B, right-angled at D (fig. 1), let A be a balloon; B, the

Fig. 1.



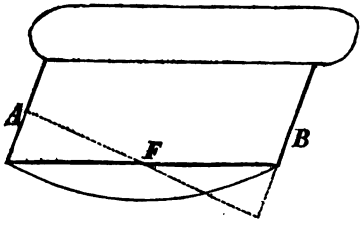
car, propelled beyond the centre of its suspension, A, by any given power of waftage. The floatage is equivalent to the weight, and the atmospheric resistance equivalent to the propelling power. From this it is proved that *a* is to *b* as the weight or floatage is to the resistance or propelling power. Taking the floatage at 10 tons, and the propelling power at 1 ton, the deflection from the perpendicular would be about 6°, and this would be the case at whatever height the balloon were placed above the car. The more flexible the connection between the balloon and car the better; for, if the connection be rigid, the car will share in the deflection, and, unless the paddles be shifted so as to continue to exert a horizontal force, the machine will rear up and fall back, as Mr. MacGregor stated my balloon would do. It would therefore be necessary to take away the posts I planned for fixing the balloon, and

Digitized by Google

to havo ropes only, if the cylinder were made very large.

That the balloon, when bent back by a horizontal resistance, does not tend to raise the power of the car, is evident from fig. 2, wherein, by drawing per-

Fig. 2.



pendiculars from the fulcrum F to the ropes A B, by which the balloon exerts its elevating power on the car, we find that the leverage by which the rope A tends to raise the prow is equal to the leverage by which B tends to raise the stern. The yielding nature of the balloon might cause B to deflect less than A, in which case the prow would be depressed. Thus, Mr. MacGregor's argument against my machine, entirely falls to the ground.

From these considerations, it appears that the Archimedean Balloon need no longer be deficient in buoyancy, seeing that the cylinder may be considerably enlarged without disturbing the equilibrium of the machine in any material degree. This view of the case suggests some alterations in the build of the machine; but this part of the subject I shall not enter upon at present.

When I stated, in my reply to "Argus," that "the rude pressure of storms and tempests to which navigable balloons have been thought liable, exists only in the imagination," of course I did not mean my remark to apply to the case of a balloon riding at anchor. I think it as well to make this observation, since I find that Sir George Cayley takes into consideration the effects of storms upon balloons fixed to the earth.

It has been asserted that a rudder of any kind would be of little use to keep my aërostat always pointed in the right direction: this I have disputed; but supposing the assertion to be verified, *are not the paddle-wheels capable of steering the machine?* This, again, requires some alterations, which I defer treating upon till another opportunity.

In the plan I have given of my paddle-wheels in a former number, it will be seen that the floats are drawn as beating the air through nearly half a revolution. Of course, by altering the grooves in the guide-wheels, the floats can be made to beat the air through a smaller portion of their course, and to do so would doubtless be advantageous.

I cannot despair of using steam as a motive power, except for purely mechanical flying, since Sir G. Cayley has proved, that "there must ever be, *theoretically*, some bulk (of buoyant power) in which any species of first mover, however sluggish in proportion to its weight, would find itself suspended, and its power adequate to propel that bulk with the required velocity."

I am not aware that the arguments I have adduced, concerning the equilibrium of navigable balloons, have been overthrown, but they seem to have been overlooked by some. If the philosophical baronet has reasoned unsoundly, or if I have drawn erroneous deductions, I shall feel obliged to any one who will be so kind as to enlighten me.

"I pause for a reply," and remain, Sir,

Yours very respectfully,
JOSEPH PITTER.

Hastings, September 2, 1847.

YACHT SAILING.

Sir,—I shall conclude my observations upon Yacht Sailing by a few miscellaneous remarks. But first allow me to express a satisfaction, shared in, no doubt, by your other nautical readers, that one so able as Commander Shuldham should be found willing to add to our knowledge in this department; for naval science, perhaps more than any other, is indebted to the scattered results of experience, which require to be collected and collated before sound conclusions can be deduced.

A cutter sailing on a wind generally carries weather-helm. When the breeze freshens, the tendency to luff up is increased in a much greater ratio; and, indeed, the rudder would be unable to resist it, were its influence not assisted by the greater resistance on the lee midship section as the hull lies over to the

Digitized by Google

pressure of the wind. For it will be seen, that, as the plane of the keel is inclined from the vertical, the resistance which the after deadwood offers to rounding-to, is more diminished than that of the entrance or bows to paying off the head from the wind. Less weather-helm will suffice when the stern-post is well raked; for the horizontal resistance at the bows is thereby diminished in consequence of the depression of the run. One cause of the easy steering of screw-propelled vessels, is the removal of a great part of the deadwood abaft the axis of rotation. Theoretically, this axis about which a vessel turns in tacking, will pass through the centre of gravity; but, in sailing vessels, we must consider as forces, the beam pressure on the sails, as well as the horizontal forces acting on the entrance and run. So that, in practice, when the head-sails are loose, and the flooring flatter forward than aft, the axis will, in fact, be much abaft its theoretical position; for the first of these causes is always less powerful than the second.

The helm should never be shifted too suddenly; first, because the gradual expending of a force, when applied to a non-elastic body, is more efficient in producing motion among its particles than when concentrated in the manner of an impulse, just as sand, which yields to gradual pressure, will resist the greater force of a smart blow; and second, because, before the water can be moved horizontally, the way of the vessel is much decreased by the rudder. While on this point, I am reminded of the backwardness of many sailors to take immediate advantage of stern-way. When a vessel in stays unfortunately acquires stern-way, the fact is soon made known by a certain indescribable *dead* feeling; and the helm should be instantly reversed in inclination. The most obstinate sailing-boat may often be put about by a ready alteration in its centre of gravity; namely, by increasing the weight forward during the first part of the process, and by increasing it aft at the instant that the head begins to pay off on the new tack. I think that the day is coming when cutters will carry their keels parallel to the water-lines, and when the present tendency to lengthen the forefoot will be even stronger and more general. This will render necessary more head-sail, either by shortening the gaff and lengthening the hoist of the mainsail, or by prolonging the bowsprit, however inconvenient. I would ask Commander Shuldham, if he is assured that the increased effect of his convex sail was not owing merely to the flatness of the plane portion of it, and would not have been lessened had the convex part been cut away?

I am, Sir, yours, &c.,

JOHN MACGREGOR.

P.S. It is hardly necessary to call attention to the mistake of your printer, in substituting "balloon" for "rocket" in my last communication.

Dublin, Sept. 1, 1847.

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

(Concluded from page 232.)

The student who has arrived in the course of his reading to that part of Statics in which the previous principles are applied to the case of *Flexible bodies*, such as the Catenary, is very likely to feel some hesitation and doubts as to the propriety of applying to flexible bodies those conditions and equations which have been proved only for *rigid* ones. He must be reminded in the first place, that every flexible body in nature is really composed of an immeasurable number of parts or particles which are perfectly inflexible or rigid: in fact these small elementary particles are the only ones which can be said to be perfectly rigid, for in all ordinary masses, such as beams of wood or iron, &c., the form and arrangement is easily altered by ordinary pressures, so that they are in reality flexible bodies.

Between each pair of these ultimate particles there are forces of attraction (or cohesion, or whatever name you choose to give it) acting, which are to us perfectly unknown in magnitude—and all we can safely suppose concerning them is that the direction of this mutual force is the line joining the two particles, and that the pressure on one is exactly equal but in the opposite direction to the pressure on the other. On these axioms as to the direction and equality of magni-

Digitized by Google

tude in the mutual forces or pressures, we can find the conditions of equilibrium of any mass of particles whatever — whether that mass be solid, fluid, or gaseous. In this case we consider each particle as being itself in equilibrium under the action of these mutual internal forces together with any given and known external forces (such as that of gravitation), which latter are supposed known in magnitude and direction. By the Parallelogram of Forces we resolve all these forces, known and unknown, into three sets along three rectangular axes: since the particle is not to move in any direction, it is necessary and sufficient that it should be incapable of moving in any of these three particular directions (for any motion in space must displace the particle along one or other of these three lines): hence, all those forces which tend for instance to displace the particle in one direction along the axis of (x) must be counteracted by those which tend in exactly the opposite direction along this axis. And so for the other two axes of (y) and (z).

Suppose, then, that the known forces, (such as that of gravity) acting on any given particle are reduced to X, Y, Z, acting along the axes. If R denote the mutual force between this particle and any adjacent one, the line joining which makes angles (α), (β), (γ), with the axes: and similarly for the action of any other adjacent particle, we have for the equilibrium of the first particle the equations,

$$X + R\cos\alpha + \&c. = 0. \quad Y + R\cos\beta + \&c. = 0. \quad Z + R\cos\gamma + \&c. = 0.$$

the &c., referring to the other actions such as R. Now if we wished to determine the conditions of equilibrium of any one individual particle we must know R, and the angles α, β, γ, &c. But if our object be merely to get a relation amongst the external forces X, Y, Z, &c., for the whole system or mass, we easily effect this by going on to consider the equilibrium of the other particles, for here we shall see the same forces R &c., entering the equations, but with a different sign. For instance, the equilibrium of that particle, the action between which and the first we denote by R, gives the equations,

$$X' - R\cos\alpha + \&c. = 0. \quad Y - R\cos\beta + \&c. = 0. \quad Z - R\cos\gamma + \&c. = 0.$$

By thus writing down the equations for the equilibrium of each particle throughout the whole system, and then adding together the corresponding sides of these equations, it is seen that we get rid of all such unknown forces as R, and obtain,

$$X + X' + \&c. = 0. \quad Y + Y' + \&c. = 0. \quad Z + Z' + \&c. = 0.$$

in which all the quantities are the known external forces.

It must be carefully observed, that these last equations are not the *conditions sufficient* for the equilibrium of any one particle or of the whole system, (it might happen for instance that the force R was not sufficient to prevent the separation of the two particles between which it acts, when the external forces are of a certain magnitude—in other words fracture might occur in a solid body or dilatation &c. in a fluid): but they are *some of the necessary consequences when there is equilibrium.*

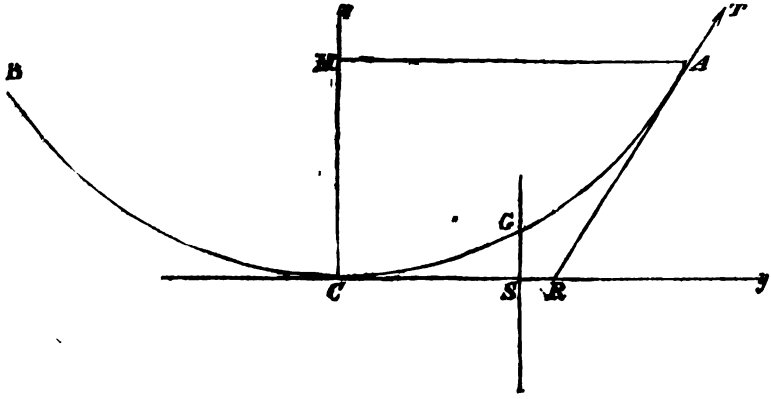
We have taken a system of "particles"—that is, have supposed that the bodies, whose equilibrium we are considering, to be so small that when one point in them is at rest the whole is at rest—in short, that there can be no such thing as rotation round a fixed point in the particle. As we have nothing to do with any such things in nature however, we must, if each of these bodies is supposed to be absolutely at rest, go on to the other equations, viz., those supplied by the consideration of "couples" or "moments." By going through a precisely similar process (and which may be found in the 3rd chapter of *Pratt's Mech. Phil.*) it will be seen that although we cannot determine the conditions of equilibrium for any particular body of the system (any further than writing down equations containing unknown quantities), yet we obtain certain relations amongst the known forces which are *necessary results* of the equilibrium if it exists, though not *sufficient* for that equilibrium.

The relation thus obtained, is the same equation or equations of "couples" or moments, as would be obtained if the whole system of internal actions were left entirely out of consideration. The

Digitized by Google

first relation, obtained above, is, that "the algebraical sum of all the forces resolved along the axes shall each = zero;" the second relation is, that "the algebraical sum of all the moments *round any point whatever* shall also = zero." This last proposition requires a little further explanation. In forming the equation of moments for any one rigid body of the system we are considering, the point about which the moments are estimated is, in the course of the *mechanical* reasoning, necessarily taken *in the rigid body itself*, or rigidly connected with it. But it is easily seen that the *same algebraical equation* or relation holds *for any multiple* of the resultant moment, that is, we may suppose the point about which the moments are estimated to be taken outside of the rigid body. In fact, it is obvious that such equations as $Xz - Zx = 0$, $Yx - Xy = 0$, and $Zy - Yz = 0$ remain true if the co-ordinates x, y, z are changed into mx, my, mz, *i. e.*, if the origin be taken differently, the new axes of co-ordinates however remaining parallel to the original ones. We are at liberty then to refer all the equations of moments for each individual body, to one common origin or point, which need not be connected with any of the bodies.

We shall now, as an example, apply these considerations to the case of the Catenary.



According to the usual notation, let the horizontal tension at the lowest point of the chain be equivalent to the weight of a length (c) of the chain, which is supposed to be of uniform thickness: then if (s) denote the length of the portion of the chain CA, the weight of this portion will be proportional to (s). Let T denote the tension at A in the tangent at that point, AR, which makes an angle (α) with the axis of (x), that axis being also supposed vertical. The portion of chain CA is composed of an immense number of links, each of which is kept at rest by its own weight together with the unknown tensions of the adjacent links. Now by the principles just set forth, we necessarily have the same relations amongst the external forces acting on AC, as would exist were they of themselves keeping the chain at rest, without any reference at all to the internal forces. These external forces are, (1) the weight of each link, (2) the tension at the lowest point, (3) that at the point A. These two latter forces are considered *external* inasmuch as we supposed all the rest of the chain removed, or at least not included in our inquiry as to the equilibrium of the portion CA. All that we have now to do is to resolve all these forces, and take their moments just as if the body were not a flexible one.

Resolving vertically, then we have the equation. Sum of all the separate weights of each link $- T \cos \alpha = 0$; or weight of $(s) - T \cos \alpha = 0$.

Resolving horizontally, tension at $C - T \sin \alpha = 0$; whence we easily have,

$$\frac{c}{s} = \frac{\text{tension at lowest point C}}{\text{weight of length of chain } (s)} = \frac{\sin \alpha}{\cos \alpha} = \tan \alpha = \frac{dy}{dx},$$

Digitized by Google

which is the equation to the curve. The tension at A is equal to

$$\frac{\text{weight of } (s)}{\cos \alpha} \text{ or weight of } (s) . \times \frac{ds}{dx}.$$

So far then as merely finding the equation to the curve, we have no occasion for the equation of moments. This however will serve us to find the centre of gravity of the portion of the chain AC; for let $\bar{x}$ and $\bar{y}$ be the co-ordinates of G the centre of gravity. Then, taking the moments round the lowest point C, for instance. Sum of the moments of all the weight of the links = moment of tension T.

$$\therefore \text{weight of } (s) \times \text{CS} = \text{T } (y \cos \alpha - x \sin \alpha)$$
$$= \text{weight of } (s) . (y - x \tan \alpha).$$

$$\therefore \text{CS} = y - x \tan \alpha = y - x . \frac{c}{s};$$

where (x) and (y) are the co-ordinates of A. Knowing $\bar{y}$ therefore we can determine $\bar{x}$ from the equation to the curve. The same might have been obtained, of course, by taking the moments round A instead of round C, and this would have also been shorter as not involving the elimination of T. The co-ordinates for the centre of gravity thus found agree with those found by different methods, which may serve to convince those who have any doubts as to the use of these "equations of moments" when the bodies themselves are flexible. A little attention however to the preceding remarks, will show clearly the grounds on which such usage is established. In the same way might be found the centre of gravity of any curve kept at rest by a system of equal parallel forces applied to each point of the curve, together with other external forces.

It will be observed also, that we have availed ourselves of the very same circumstance to get rid of unknown forces in considering the equilibrium of bodies, which we did in a former case to get rid of them in considering the motion of bodies. These inimical forces, which would otherwise prevent our attacking such problems with success, by thus waging war and mutually destroying each other, give the same vantage-ground to the mathematician which similar events do in living warfare, "internal feuds" and antagonisms allowing that to be easily seized and subdued which otherwise would be impregnable. John Bernoulli would be very apt to assert, that these internal tuggings of particle against particle, were something "real and substantial." The preceding methods are applicable to the equilibrium of all flexible bodies, and not only to them, but to fluids and gases. In the latter, it is however expedient, rather we should say necessary for the investigation of physical effects, that the unknown internal forces should be kept in the equations for the purpose of determining them, which we are often enabled to do by the aid of certain laws discovered by experiment; as for instance Boyle's law of the proportionality of the pressure to the density. It is also found convenient to consider the pressure at any point in a fluid mass as a function of the co-ordinates of that point, and as varying by imperceptible degrees from one point to another. By a very simple process the equations for the equilibrium of any portion of the fluid are formed, in which the differentials of the pressure at that point are made to take the place of such forces as R in the former part of this paper—and then, by the aid of the integral calculus the whole circumstances of the equilibrium are investigated. It should not be forgotten however that in such equations as

$$\frac{dp}{dx} = \rho X, \frac{dp}{dy} = \rho Y, \frac{dp}{dz} = \rho Z.$$

the pressure (p) is simply that which we have hitherto called the mutual action or force between two adjacent particles, and that we might, just as in the former cases, eliminate all these pressures, so as to get a relation amongst the *known* forces X, Y, Z, &c.: and that the only reason this is not done, is that this *unknown* pressure is precisely the very quantity we wish to determine by means of its relations with *known* quantities. The reader may ask why this is not done in the case of solid bodies as well as in fluids? to which we can only answer, that we are not nearly so well acquainted with what takes place in the interior of solids as we are with the laws of the

Digitized by Google

transmission of pressure in fluids, and that from the very nature of the case we are unable to experiment directly on the subject so well as in the other cases. It is highly probable, however, that the time will come when it will be as easy to assign the exact pressure in the interior of a solid body whose nature is known, as it is now to do the same for any point in the interior of a fluid such as water. The whole question of the strength of materials, as well as the still more important and intricate questions of the transmission of heat and light through solid masses, renders it indispensable that this problem should be solved before we can learn anything certain as to the mode in which such kinds of motion are propagated.

MR. BASHFORTH'S EARTHWORK TABLE.

Sir,—The reviewer in the *Mechanics' Magazine*, p. 139, has fallen into a mistake in supposing that I had not observed the peculiarity of the point from which the heights must be measured when my Table is employed, as I have been careful to explain this in articles 5, 6, and 10, and have also deducted the top prism at the end of each of the examples. It is this peculiarity that renders it possible to calculate the contents of the prismoid by the extraction of a single number from one small table, when integral numbers of feet are employed, whatever be the slopes and width of formation level.

Other tables take the zero point in the formation level; and in parliamentary estimates, it is necessary to rule a pencil line about two feet below the line of rails to obtain this starting point. There seemed to be no objection to ruling a line a few feet above the line of rails in embankments, and a few feet below in cuttings. In the case of contract estimates, numerous cross sections ought to be taken; and it matters little whether we start from the intersection of the slopes or the formation level.

The random instance of a combination of 33 feet width of formation level and 48½ feet height of embankment, with slopes of 1 to 1, seems scarcely fair, for I never heard of such high embankments being made so steep. The slopes would not be less than 1½ to 1, and on the Sheffield, Barnsley, and Wakefield Railway they are to 2 to 1 when the height of the embankment exceeds 30 feet. Consequently, the limit of my Table, to be compared with others, may be taken at 54 feet. I adopted 65 as the limit, because it made my Table fully as extensive as those previously in use, and, at the same time, admitted of being printed on a single sheet of convenient size.

This limit is, however, a matter of very little importance, as I have shown (art. 3) that the table can be extended to heights of 130 feet by merely consulting it with half the given heights, and taking four times the tabular number. If we take two numbers not greater than 65, as 64 and 54, their halves are 32 and 27, of which the tabular number is 2132, and four times this = 8528. The number at the intersection of columns 64 and 54 is 8529—the small difference of one cubic yard arising from the neglect of fractions.

In conclusion, I may state, that the tables were originally calculated for my private use; and it was only after they had proved perfectly satisfactory to myself, that I thought of publishing them.

I am, Sir, yours, &c.,

F. BASHFORTH.

RAILWAY BUFFERS.

Sir,—Sir George Cayley does me the honour of referring to my communication to the *Times* of the 15th June last, and to pass an encouraging remark thereon. I can say with Sir George, that I feel a far greater anxiety to see the Locked Buffers adopted, than I do to contest the merit of being the first, second, or third, in the invention: I feel it a duty I owe to humanity not to relax in my humble efforts to point out the superiority of the new system of buffers, whether they be *Cayley's or Rowland's*, over those already in use. I admit that the particular case of a fallen bridge did not occur to me, and I look upon that suggestion alone as a very important feature in Sir George's plan. But it has struck me that the plan of having the buffers continually locked, as suggested by Sir George, is liable to this objection: If the engine runs off the rails while traversing an embankment, and is precipitated into the bottom, is it not to be feared that the overturning of the engine and the tender would cause the

Digitized by Google

whole train, which is thus firmly locked together, to be overturned also? On the other hand, are we not to hope that the engine with *free* buffers (but still convex and concave) would, on being overturned, snap the connecting chain, and leave the rest of the train uninfluenced and uninjured?

OWEN ROWLAND.

11, Heathcote-street, Mecklenburgh-square.

THE NEW PLANET, NEPTUNE.—AMERICAN OBSERVATIONS.

[From a lecture delivered by Professor Mitchell, of the Cincinnati Observatory. Reported in the *Eureka*.]

I proceed to the examination of the solar system, with a view to introduce the discovery of the new planet. We are indebted to Bode, of Berlin, for the discovery of a law which determines in a very singular manner the relative distances of the planets. He found that, by taking the series of numbers

0 3 6 12 24 48 96 192

and adding four to each term, making a new series of

4 7 10 16 28 52 100 196

he had an exact table of the relative distances of the planets. Our earth is placed at "10," and the other *old planets* are ranged to the order of their distances, giving the following result:

4	7	10	16		28		52	100		196
☿	♀	⊕	♂				♃	♄		♅
☽				Blank—subsequently filled by the discovery of the Asteroids.					Blank—filled by the discovery of Herschel.	

As will be seen in the table, there was found to be an interval between the orbits of Mars and Jupiter, the law was broken—there was no planet to fill up the space. The idea occurred, that there might be a planet revolving within the orbits of these two planets, and astronomers were watching eagerly for any phenomenon that might present itself in that part of the heavens. It so happened, that at the beginning of the century, and on the very first day of the century, Piazzi, of Palermo, finds entering that portion of the heavens an object that ought not to be there, if his charts are true. It had the appearance of a fixed star, but, by its motions, it ought to be a planet. For forty days he followed it up, noting its position night after night, till finally a sufficient number of observations were obtained to enable him to determine the limits of its orbit—and behold! it filled the space in the extraordinary series, completing and making it a perfect scale from beginning to end. I will but advert to the other discoveries. In a few years another body was added, and then another, and then a fourth, making four small planets between Mars and Jupiter. It was believed that there would never be another found. It seemed that the whole heavens had been explored, and so thoroughly, that no object could have escaped the scrutiny. But on the 12th of December, 1845, we find it announced by Encke, of Driessen, in Germany, that he had added a fifth star to the number; and now we have five small planets revolving between Mars and Jupiter.

The system being now complete, we go out at once by means of this series to the most distant of all the old planets—the planet Saturn. Before the close of the last century, it was noticed that there appeared to be some disturbing influence exerted upon this planet. It was found that it was not even in its motions; it was irregular, and its irregularities were induced by influences lying, possibly, upon the exterior of the orbit of the planet. But no mind was found bold enough to enter into an investigation of the causes of these phenomena at that day. In 1781 a fortunate accident revealed the cause. Sir William Herschel finds a new comet. But when the mathematician takes up his apparatus and examines it, he finds that this comet is, in fact, no comet, but a planet. He finds that the object which Herschel had revealed to the eye, was a large planet, far distant from the sun. This seemed to be the last link in the mighty chain that science had been so long forging. It seemed to be impossible to reach beyond this limit, for this star or planet is not visible without the aid of a telescope. It is 18,000,000 miles from the central sun. In a little time it was found that this planet had already been seen years before. It was found that the old astronomers had remarked it, but had believed it to be a fixed star. This gave great advantages to the modern astronomers, for they found it possible to avail themselves of the computations of the ancients in their investigations. Its movements were watched, and it was found utterly impossible to reconcile the old observations with the new ones. In 1781, Bouvard, a French astronomer, turns his attention to the subject. He finds it impossible to reconcile the new with the old computations, and it is impossible for him to settle whether the discrepancy grows out of the imperfection of the instruments or the action of some unknown force in the heavens. At length he said, "I will reject the old—I will adopt the

Digitized by Google

new; I will compute the elements of this planet, and compute the tables by which I shall be guided." These tables were computed; but in a few years we find the computed and the observed planets again disagreeing. The planet was getting in advance of its computed place—it was getting farther from the sun than it ought to be.

As early as 1833 we find the astronomer Roual observing with great accuracy the fluctuations of this planet, and after attempting the influence of every force that could be brought to bear upon its movements, he found that the planet had increased its distance from the sun twice the distance of the moon from the earth. What power was there concealed in the vast depths of space, that could exert such an influence over this planet?

For a long time no mind dared to touch the problem. At length a young astronomer rises, unknown to fame, but with a mind capable of grasping all the difficulties involved in any of these questions. I refer, of course, to Leverrier. He began by taking up the movements of Mercury. He was dissatisfied with the old computations and the old tables, and he ventured to begin anew, and to compute on an entire new set of tables. With these new tables, he predicted the *precise instant* when the planet Mercury, on the 19th of May, 1845, would touch the sun and sweep across it. The time rolls round when the planet is to be seen, and his prediction verified or confuted. The day arrives, but alas! for the computer, the clouds let down their dark curtains, and veil the sun from his sight. Our own observatory had just been finished; and if the audience will permit, I will state briefly my own observations upon the planet. I had ten long years been toiling. I had commenced what appeared to be a hopeless enterprise. But finally I saw this mighty telescope erected; I had adjusted it with my own hands. I had computed the precise time when the planet would come in contact with the sun's disc, and the precise point where the contact would take place; but when it is remembered that only about a thousandth part of the sun's disc enters upon the field of the telescope, the importance of directing the instrument to the right point will be realized. Five minutes before the computed time of the contact, I took my place at the instrument. The beautiful machinery that carries the telescope with the sun was set in motion, and the instrument directed to that part of the sun's disc at which it was anticipated the contact would take place. And there I sat, with feelings which no one in this audience can realize. It was my first effort. All had been done by myself. After remaining there for what seemed to be long hours, I inquired of my assistant how much longer I would have to wait. I was answered *four minutes*. I kept my place for what seemed an age, and again inquired as before. He told me that but one minute had rolled by. It seemed as if Time had folded his wings, so slowly did the moments crawl on. I watched on till I was told that but one minute remained, and within sixteen seconds of the time I had the almost bewildering gratification of seeing the planet break the contact, and slowly move on till it buried itself, round, and deep, and sharp, in the sun.

I refer to this fact for two reasons: first, to verify Leverrier; and second, to impress on your minds the desirableness of locating our observatories in different parts of the earth. No European astronomer could have made this observation, because in their longitudes the sun would have set previous to the contact of the planet with its disc. I had the gratification of furnishing these observations to Leverrier himself, who reported upon them to the Academy of Sciences. The triumph of Leverrier was complete. It was after this that Arago, seeing the characteristics of his mind, said to him, "Take up the movements of the planet Herschel, watch them, analyse them, and tell us what it is that causes them." Leverrier throws aside all other employments and gives his mind to the investigation of this subject. He begins entirely back. He takes up the movements of the planets Jupiter and Saturn, and investigates them anew, he leaves nothing untouched. Finally, after having in the most absolute manner computed all the influence they exercise upon the planet Herschel, he says, "I now know positively all existing causes that disturb the planet, but there is an outstanding power that disturbs it not yet accounted for, and now let me rise to a knowledge of that outstanding cause." He did what no other man ever had attempted. He cleared up all difficulties, he made all daylight before his gaze. And now, how shall I give to you an account of the train of reasoning by which he reached out into unknown space and evoked from its bosom a mighty world? If you will give me the time, I will attempt to give you an idea of his mighty workings in the field of science.

In the first place, let it be remembered that the planets circulate through the heavens in nearly the same plane. If I were to locate the sun in the centre of the floor, in locating the planets around it, I should place them upon the floor in the same plane.

Digitized by Google

The first thing that occurred to Leverrier, in looking for the planet, was this: he need not look out of the plane of the ecliptic. Here, then, was one quarter in which the unknown body was to be found. The next thing was this: where is it located, and what is its distance from the sun? The law of Bode gave to him the approximate distance. He found the distance of Saturn was about double that of Jupiter, and the distance of Herschel twice that of Saturn; and the probability was that the new planet would be twice the distance of Herschel; and as Herschel's distance is 1,800,000 miles, the new planet's would be 3,600,000. Having approximated its distance, what is its periodic time?—for if he can once get its periodic time, he can trace it out without difficulty. According to the third of Kepler's laws, as the square of the period of Herschel is to the square of the period of the unknown planet, so is the cube of the distance of Herschel to the cube of the distance of the unknown planet. There is only one term unknown. The periodic time of Herschel we will call 1, and its distance 1, and by resolving the equation, we find the periodic time of the new planet to be a fraction less than three times that of Herschel, or about 220 years. Now, if it be required to perform 360 degrees in 220 years, it will perform about a degree and a half in one year. Only one thing more remains to be accomplished. If it is possible to get the position of the unknown body at *any time* we can trace it up to where it should be in 1847.

First, then, let us suppose the sun, Herschel, and the new planet in certain fixed positions, which we will represent as follows:

☉	♅	♇
Sun.	Herschel.	Unknown, or Leverrier planet.

It will be observed that a line drawn out from the sun to the right will pass through Herschel, and if continued, will intersect the new planet. It is very apparent when these three orbs occupy the position assigned them above, the influence of the unknown planet upon Herschel will be exercised in the highest degree, and consequently that Herschel will be drawn farther from the sun at that juncture than at any other; and if we know where *Herschel* is when this effect is produced, by prolonging the line through Herschel outward, it must pass through the new planet. The delicate observations upon Herschel gave this result, and showed when it was that it was swayed farthest from the sun. By taking the place occupied by the planet at that time, and increasing it onward one degree and a half per annum, we can point out the place it must occupy at any given period. In September last we find Leverrier communicating these results to his friends in Berlin. They are provided with charts, on which every observed star is mapped down, and if any new object presents itself in the heavens it is immediately subjected to a rigid scrutiny. On the very night on which Leverrier's letter had been received, we find the telescope directed to the designated point in the heavens. A stranger appears, but has only the aspect of a fixed star. Long did the eye watch that night, but no motion was found. When twenty-four hours rolled round, and it was once more possible to fix the instrument upon this strange planet, it had moved in the precise degree and direction computed. The new planet was found. The news spread with the utmost rapidity throughout the world, all Europe was electrified, and soon the intelligence crossed the waters. Our telescope was directed to this object. All had hitherto failed, no eye had ever seen it round and planet-like from its disc. The evening finally came round for the examination. Time moved on its leaden wings, but twilight faded away at length, and I took my seat, with my assistant, at the instrument. I directed the telescope to that point of the heavens. I found four stars in the field of view. The first was brought to the field of view of the instrument, and pronounced to be a fixed star, and so with the second. The third was brought forward, and before it had reached the centre of the field, I heard the exclamation, "There it is!" and there it was, as bright and beautiful as Jupiter himself. Here was a result not attained by any other instrument in the world. When we know that a body is a planet, then, and not till then, do we find the disc. The great rival of our instrument had seen it, but did not recognise it.

Before five minutes had elapsed the micrometical wires pronounced its diameter to be 40,000 miles.—Here were results such as no previous one had attained. I mention it, because I think it is right that our own country, which has but just commenced its career in this science, should know what is her due; and I trust the day is not far distant when we shall become as distinguished for our proficiency, for our learning, for our researches, and for our efforts in behalf of astronomy, as we have hitherto been for our profound neglect of everything belonging to this sublime science.

Digitized by Google

We were much amused by the appearance, in the *Times* of Monday last, of the following paragraphs:

"We perceive nearly all the accounts, mentioning the extrication of the *Great Britain*, award the credit of the accomplishment of that feat to all *but those who assisted most in that eventful work*—we mean that the names of Mr. Bellamy, Assistant-Master Attendant of Portsmouth Dockyard; Commander Ingram, of Her Majesty's ship *Birkenhead*: and Commander Caffin, of Her Majesty's ship *Scourge*, are not even mentioned in some prints which have published most about this affair, or, if mentioned, so casually as scarcely to engage the notice of the reader, and their ships alluded to only as mere tugs.

"*All this is very unfair*; as we know that the first-named of the above scientific gentlemen, and the party of 60 riggers and shipwrights under his command, went on board the *Great Britain* on the 10th of August, and continued to live on board, and work—watch and work—both night and day, until she was afloat, and navigated her, in tow of the *Birkenhead* steam-frigate, to Liverpool.

"The following acknowledgment of the talent displayed and services rendered by Her Majesty's officers and men from the Lords of the Admiralty, will, however, be some little reward for the untiring perseverance exhibited by them in the pursuit of their arduous and responsible labours:

"'Admiralty, August 31.

"'Sir,—Having laid before my Lords Commissioners of the Admiralty your letters of the 28th, 29th, and 30th instant, I am commanded by their Lordships to acquaint you that they have learnt with much satisfaction that the assistance afforded by yourself, your officers, and ship's company, together with those of Commander Caffin, and the officers and crew of the *Scourge*, aided by the skill and labour of Mr. Bellamy, and the dockyard party and men of the *Victory* under his orders, *have proved effectual in the removing the Great Britain from the beach in Dundrum Bay, and in finally transporting that vessel to Liverpool.*

"'My Lords are aware of the extreme toil undergone by all engaged in this work; and the persevering zeal and good conduct of all parties employed are thoroughly appreciated by their Lordships.

"'I am, Sir, your obedient servant,

"'W. A. B. HAMILTON.

"'To Commander Ingram, Her Majesty's

"'ship *Birkenhead*, Liverpool.'"

Why, what journal was so forward as the *Times* itself in awarding the credit of the feat "to all but those who assisted most in the eventful work?" Was it not the *Times* itself which first described it as one of the greatest triumphs of *engineering* talent, as applied to the raising of a stranded ship, upon record? And what have been all the other accounts of the affair which have since appeared—*with one exception*—but echoes of the same ignorant and foolish praise? The single exception to which we allude, is the *Mechanics' Magazine*, which was the first and only journal to protest against the credit awarded by the *Times* and all the rest of the press to the *engineer* salvors, and to put in a word for the seamen and dockyard men employed on the occasion. We repeat the words we used last week:

"Whatever may have been the *nautical* skill shown in working the purchases (for which, we presume, the seamen and dockyard riggers must be allowed the principal credit) it is not by means of any engineering ingenuity or science which the Messrs. Bremner have brought to bear on the task, that the ship has been saved. To say that her rescue is 'one of the greatest triumphs of engineering talent' is simply absurd. Of 'engineering' talent there has been none at all—not a vestige; and of talent of any sort, as little as may be."

We adhere to these words, with but one slight qualification. The last member of the last sentence should have run thus:—"and of talent of any sort on *the part of the engineers*, as little as may be." The context of the passage shows that we did not mean to say but that there might have been "*nautical* skill," and plenty of it, exhibited on the occasion.

The *Times* has followed up its (not very candid) recantation by the publication of an exceedingly interesting narrative of the operations, furnished by "An Eye-Witness."

We subjoin the main parts of this narrative entire; first, because it is well deserving of more permanent record than the pages of a newspaper; second, because it enables us to correct some errors in previous statements; and third, because it confirms, upon the whole, in a very remarkable manner, the views which we have expressed on the subject. The reader will perceive that the notable sand-boxes of the Messrs. Bremner were of little or no use at all till they were *emptied of their sand*, and converted into camels; and that, as camels, they might have done good service, but rendered none, because most of them were leaky, and none of them made fast enough to the vessel (not much "engineering" in this, surely). When we said (ante p. 234) that there were no camels employed, we did so because in none of the statements which had appeared up to that time, had any mention been made of the conversion of the sand-boxes into camels; that was a piece of information kept

Digitized by Google

back till the present week, and furnished at last neither by Captain Claxton nor the Messrs. Bremner. The reader will see further, from the account of the "Eye-Witness," that, in the end, the whole of the "engineering" efforts so much boasted of, went literally for nothing; and that, had it not been for the tough sinews of a body of our hardy tars—"*such a heave*," to use the words of the narrator, "as sailors alone can make"—and but for the help also of a not less efficient pull from a pair of powerful steam-engines, the *Great Britain* might still, at this moment, have been laying imbedded in the sands of Dundrum Bay:

"On Monday, the 23rd of August, Her Majesty's ship *Birkenhead* took up her station for the second time in Dundrum Bay, about a mile and a half from the *Great Britain*. She brought with her two lighters, which she had taken in tow off Carlingford Lough, and cast them off, anchoring herself, and sending her boats to tow off the lighters without loss of time towards the *Great Britain*, together with a party of men in aid of the operations on the beach. Her Majesty's ship *Scourge* hove in sight early on Tuesday morning, and anchored about a quarter of a mile outside Her Majesty's ship *Birkenhead*. Her men were soon sent on board the *Great Britain*, contributing their welcome and much required services along with their comrades of the *Birkenhead*. These had been this day engaged in transporting the spare crew of the *Great Britain* from her deck to that of the *Birkenhead*, whereby the great ship was relieved from the weight of four tons. Next day the carpenters of the *Birkenhead* and the *Scourge* were busily engaged in making the temporary rudder and preparing the lighters for their position alongside the *Great Britain*. This position was to be under large logs of wood stretching out from the ports, called outriggers, kept down by large timber shores. Others of the ships' crew were employed in securing the "camels," *which, however they might have served as levers when filled with sand, were ill adapted to the work of lifting the ship as now applied; for, being neither wind nor water tight, they were most of them useless as they were unmanageable.* Others were labouring heavily at the pumps. The tide rose high, and it was whispered that the gallant Captain Claxton, whose energy is no less conspicuous than his judgment, had determined, if possible, to heave off his heavy charge upon the hawsers and cables of the iron ship itself. Surprise and anxiety, mixed with misgivings, accompanied the announcement. The *Great Britain, lifted by the lighters, camels, empty barrels, and rafts of wood*, evidently moved, and very slowly yielded, and only very little to the strain employed. All was animation, hope, and joyful expectation, every heart responding to the captain's hearty cheers. Darkness came on—a sudden crash was heard as the falling in of a roof, and now a noise like the report of cannon announced the failure of the blocks of wood, the wedges, and the camels, which, bursting from their hawser-bands, *by which, under the engineer's directions, they had been too lightly fastened, became useless. It seemed, in fact, as if the enormous body with which they had to deal had surpassed their calculations and baffled their energies.*

"The Leviathan, however, had moved about 20 feet, but she was yet deep in her sandy bed. At the ebb of tide, Her Majesty's ships' respective crews were again required; and their exertions were renewed, as well in keeping down the water in the *Great Britain* by continual pumping, as in repairing and replacing the various apparatus for lifting the mighty prisoner.

"On Thursday Her Majesty's ship *Birkenhead* steamed quietly into her position, as it had been previously occupied, and carefully marked by buoys, having let go both bower anchors and veered to 100 fathoms upon each cable. The hawsers, 400 fathoms, laid down on the former trial, were taken in through the stern horse holes, and on this occasion they were passed over the large paddle-box boats, each capable of containing 140 men, lashed together and placed close to the screw of the *Great Britain*, to which they (the hawsers) were fastened. A fulcrum was so provided for the lever which the hawsers would thus form for lifting the massive burden they were designed to move, without diminishing the force of the tremendous strain to be employed in dragging it from its stronghold. The signal was given—the bars of the capstans were ready manned, and they began to heave, but they heaved in vain. When the *Birkenhead* took up her position, the water was smooth as a millpond, the sun smiling upon the operation, although the light clouds upon the caps of the Morne mountain indicated change of weather; symptoms of a breeze from the south, and with so much reason, to be dreaded in this dreary bay, "moved upon the face of the waters" The rising tide lifted the lighters with their logs of wood up to the outriggers, and the rest of the varied apparatus; but the *Great Britain*, overwhelming these with her monstrous weight, seemed to bid defiance to the means devised by human skill alone, although applied with steadfast perseverance; some power superior was requisite. The camels, which were water-tight, were too large to be confined with the hawsers used, powerful though they were, and they bounced out of their strongholds with loud reports. Such as were leaky became waterlogged, and helped to obstruct the heave. The lighters seemed to slip from under their burden; the blocks flew out of their places, some of the outriggers and their shores yielded to the pressure, cracking with a frightful noise, and the great and powerful, but the steady strain upon the hawsers, by the purchases and capstans of the *Birkenhead*, was utterly futile. The iron mass could not be moved this day by these means, added to the lesser, although more numerous, purchases employed in the *Great Britain* itself. The signal, "She won't come off this tide," cast a damp of disappointment over every countenance, and of despair as to the result over the spirits of many deeply interested in the stirring event.

"The wind had, indeed, set in so fresh from the south, the very quarter fraught with peril to this shore, and of whose ravaging effects Captain Claxton had such dismal proofs, that the apparatus could not be replaced for a further trial on the next flood tide; and early the next morning, with the aid of such of the ships' companies as could be spared, and with care, as much as possible, to remedy the causes of failure in the former application of the lighters, &c., and the reduction of water in the hold, a renewed attempt was made on the part of Her Majesty's ship *Birkenhead* with the rising tide.

"The dreaded south wind had brought in an increase of tide. The officers and ship's company of the *Birkenhead* had made every arrangement for the renewed effort with *a more powerful and effectual heave, such as sailors seem alone qualified to make.* The powerful steamer was brought into her position again. The most watchful attention to the minutest points were observable in every officer of the *Birkenhead*, each one in his place, aiming at the success of all that was intrusted to him. Not a word transpired amongst the seamen. Signals were agreed upon. 'Heave'—'Heave with all your might'—'Avast heaving.'—'She won't come off'—and 'She moves.'

"On the first signal 'heave,' the hawsers, already on the stretch, were hove with a steady work-

Digitized by Google

ing step. 'Heave with all your might,' was responded to by the increase of pace applied with all the vigour of the men, each vying with his fellow to lift the vessel off. 'She moves' animated every countenance; each eye sparkled with the light of hope, which warmed also every heart with an inexpressible mixture of gratitude and joy. The hawsers came in nicely. 'She is all your own, my boys,' was responded to with cheers and fresh exertion. *The great steam ship obeyed the hempen calls of her iron consort.* The weight again seemed all at once to increase, as if the sand had come in contact with the *Great Britain*; but it was not so. Her gallant captain, elated, as he well might be, with success and gratification, had prudently cast his anchor, limiting the distance of the first movement of the leaky vessel to a point so near the low water mark as to secure her floating with the next flood tide; but still so high and dry upon the sand as to admit of an inspection of her bottom, and such reparation as might diminish the influx of water, and justify or not the attempt to float her on the ocean.

"The retiring tide exhibited the celebrated iron steamer, upright, high and dry, at once the astonishment and the admiration of every beholder. Now were to be seen the carpenters, and every one else fitted for such work, with staves, and wedges of wood, and oakum, and grease, and everything that could be used with probability of success, stopping up holes, repairing breaches, and stanching the leaks, which were terrific. At this juncture the Irish labourers refused to work the pumps, which compelled new labours from Her Majesty's crews. These indefatigable men were ready, though their summons was exceedingly short. A light at the peak was to announce the want of men, and in five minutes, dark though it was when it appeared, away went 25 of the men who had been labouring for previous days and nights, from each of Her Majesty's ships. The motion of the *Great Britain* was diligently watched. A messenger came for men to take up hawsers and bring in the paddle-box boats from the distance of nearly two miles. The boat was presently manned and pushed off. It was too dark to see what was going forward. But soon the foresail was spread—the wind which had lulled veered round from south to west, and now a gentle breeze from north-west came off the shore, and favoured the floating off the *Great Britain* from the beach. She evidently approached the *Birkenhead*, insomuch as to create some apprehensions of her running foul of her. With her came the paddle-box boats, and then the crew of the *Birkenhead* to heave up the anchors. It was then made known that Captain Claxton had been forced to slip his cables, and cut his hawsers, to escape being stranded afresh on the shallows of Dundrum Bay.

"To enable the men to heave the anchors, they had been taken from the pumps. Meantime it was apprehended that the leaks being so great, and the accumulation of water so rapid, the ship could scarcely keep afloat. It was a moment of intense anxiety. The labour of heaving the anchor seemed to have increased tenfold, and every moment begot the painful feeling that without help at the pumps she must go down. She appeared low in the water, and, in fact, the engineer betrayed such misgivings as to require that both the *Birkenhead's* paddle-box boats might be lashed alongside for safety, in case of an emergency he seemed to dread. The anchors up, the towing hawsers were soon attached, and when she yielded to the paddle-wheels of the *Birkenhead* much anxiety subsided. The return of men to the pumps reduced the water mark. Fresh hope was excited, and Strangford Bay, some two hours' distance, promised security to the heavy charge. The sun began to dawn, and we passed St. John's Lighthouse, when 'Direct for Liverpool' was shouted from the sister vessel. On reflection, however, it was deemed by Captain Claxton, that men of whatever mettle, exhausted as they had been by the almost incessant labour of three nights and days, could not stand to the pumps, as it was needful, for the many hours ere the port of Liverpool could be made. The pilot provided was well acquainted with the narrow passage into Strangford Louth; but it was very narrow, and the current very strong. The *Great Britain* was very unmanageable. She would neither lead nor drive in any steady course; sometimes she seemed as if she would go right ahead and give the *Birkenhead* the go-by, had it been possible. Again, she crossed her towing path to try the starboard side, and then, as if sulky under her restraint, presented herself almost broadside to the draught. The pilot looked aghast, and said, 'The hawsers must be shortened; I cannot take her in if she yaws this way.' At this critical juncture, near the shore, and narrow entrance to the bay, a thick fog came on, so dense as to render the land invisible, and the very sight of the huge vessel, near as she was, to be indistinct. The *Birkenhead's* head was turned to the sea, and Belfast Harbour was determined upon. This was made with all the speed that could be made with such an unmanageable floating log. Off the Copelands, where the current is strong, the *Great Britain* seemed to set at nought her guide, broke the hawsers, and threatened great obstruction to every effort made in her behalf. Boats, however, were lowered down, and fresh hawsers being soon attached, we arrived without further accident in Belfast Lough. The *Birkenhead* cast anchor, loosing the hawsers from the *Great Britain*, which was towed into more shallow water by the *Scourge*, and finally was grounded on the mud, which helped to stop her leaks. On the following day, with fresh hands engaged by Captain Claxton to man the pumps, the *Great Britain* was taken in tow again by Her Majesty's ship *Birkenhead*, leaving the *Scourge* at anchor, and without any remarkable or untoward event but that of yawing from side to side, and now and then presenting almost her broadside, the great steamship floated gallantly and quietly to within about an hour and a half of the bar of the Liverpool port. The wind had now begun to blow fresh, the tide being at the same time very strong, when, in reply to the summons of a gun and signal, a pilot came on board the *Birkenhead*. The *Great Britain*, profiting by this slight alteration of the hawsers, began to be unmanageable. Striving with wind and tide for her liberty, she broke the starboard hawser close to her bow, which recoiled with violence upon the poop of the *Birkenhead*. The line prepared to lay out another hawser next snapped like packthread. The second hawser and the second line soon shared the same fate, and with terrific rapidity threatened desolation. The boats were soon lowered, and fresh hawsers were soon stretched out and fastened to the steam ship. Now, one of the large beams shipped in support of the substitute for a rudder to the *Great Britain*, gave way, and falling overboard caused much anxiety and delay. At length, with difficulty, through the swell that had arisen and the increasing wind, we proceeded, and with much apprehension lest through any further delay the present tide, together with all the labour, should be lost, the ship being wild and ungovernable. A second pilot-boat came alongside, and was eventually towed astern of the *Great Britain*, acting beautifully as a rudder, and facilitating thereby the entrance of the *Birkenhead*, with her charge, over the bar and through the channel into the Liverpool harbour.

"This service was performed after the rate of six and a half knots in the hour, including all stoppages, without loss of life or limb, and it may be said, without injury, save a few bruises sustained by a few individuals of the gallant and indefatigable crew, and the *Great Britain* was triumphantly brought into port in the presence of thousands, who rent the air with their joyful and congratulatory acclamations.

Digitized by Google

THE DUNDRUM BAY "TRIUMPH OF ENGINEERING TALENT."

Sir,—I quite agree with you, that the quantum of engineering talent brought to bear upon the rescue of the *Great Britain* steam-ship, was of the most meagre description. The whole affair seems to have been a complete series of blunders, from first to last, not by any means excepting the master blunder of running this fine vessel upon the Dundrum sands. Perhaps a few anterior blunders might be included,—such as building the monster in a situation from which she could only be rescued at great labour and expense.

At the very moment that Captain Claxton was sighing for a foot more water, every possible appliance was being employed to raise the vessel—that is to say, to raise the line of flotation still farther (!), so that Captain Claxton might have to sigh for two or three feet more water, instead of for only one foot.

Had the immense boxes, which may be seen, in the various "illustrations," dangling at the top of posts stuck in the sand, been employed as caissons, (in which capacity they would have had the effect of lowering the line of flotation several feet), Captain Claxton would have had water sufficient at the very time he was bewailing the want of it so bitterly.

The whole of the sand-box apparatus, and all the other multifarious and expensive appliances, could have had nothing to do in the removal of the vessel seaward. The local fixity of these tacklings must have rendered it necessary to cut all connection with the vessel before she "put to sea."

But, not to lengthen this communication, could not a quarter tide coffer-dam, say about 3 or 4 feet high, formed round the vessel, and pumped or bailed out every tide, have afforded sufficient time to repair the bottom of the vessel? This being effected, and a channel cut in the sand, the rescue of the vessel would have been accomplished with little expense, and without any of that flourish of trumpets which accompanied it.

I am, Sir, yours, &c.,

Δ.

VELOCITY OF THE ELECTRIC CURRENT.

Sir,—I have long had an idea that the velocity of the electric current might be measured by actual experiment; but, not having the opportunity myself, I beg leave to introduce the subject into your columns, hoping that some of your readers will take up the experiment, and publish their results through the same medium; as I am sure it is a very interesting subject, and possibly might be of great importance in a scientific point of view. The wires of an electric telegraph seem to me to be peculiarly adapted for this experiment.

If an electric discharge could be made to traverse a very long conductor (say 200 or 300 miles), and both ends of the circuit could be made to pass through one and the same circular disc of prepared paper, or other material that would take an impression of the discharge as it passes through it; (both ends of the wires that transmit the current through the disc, ought to be in the same radius:) then, by causing the disc to revolve at a great velocity, it seems probable that the marks would be thrown asunder to an angular distance, proportionate to the velocity of the revolving disc; consequently, the velocity of the electric current would become known.

To avoid trespassing too much on your pages, I have only just hinted at the principle of the experiment, as any one intending to try it, will use such means as seem best adapted to his own views; but, if any further explanation or information, that I can give upon the subject, will be of any service, I shall be glad to forward it at some future time.

I am, Sir, yours, &c.,

CHAS. CROSLAND.

Holme, Sept. 6, 1847.

ADCOCK'S SPRAY PUMP.

Sir,—In your 1248th number, there is an article on the Spray Pump erected at Llanhithee, Monmouthshire. As the account there given, coupled with Mr. Adcock's subsequent advertisement in the papers, may mislead persons who are unacquainted with the true state of affairs at Llanhithee, I beg to call your attention to the following memoranda, taken on the spot, and in the presence of several gentlemen connected with the mining interest of Monmouthshire:

To raise the water, Mr. Adcock employs air compressed by a blast cylinder of 48½ inches in diameter, and 6 feet

Digitized by Google

stroke of piston—number of double strokes per minute, 20. The pillar of blast oscillates from 3 to 5 lbs. per inch; but, taking 4 lbs. as a mean pressure, it will, by calculation, give 54 horses as the available power of the blast cylinder.

Section of pit, 240 feet; depth of water blown up in 8 minutes, 2 feet 6 inches; supposed height to which the water in the pit would have risen in the same time, 1 foot; making a total depth of 3 feet 6 inches, which, multiplied by the section of the pit, gives 840 cubic feet of water blown to a mean height of 20 feet in 8 minutes, which, by calculation, is barely equal to 4 horses' work.

Thus it appears that, instead of raising water with less power, Mr. Adcock, with his patent spray pump, employs full *thirteen times* as much as would be required with a common pump.

If this is the result of six years experimenting, I think that the sooner it is abandoned the better.

I am, Sir, yours, &c.,

CASSELL MORLAIS.

Merthyr, Sept. 8, 1847.

DESCRIPTION OF A NEW PROCESS FOR MANUFACTURING WHITE LEAD, OR CARBONATE OF LEAD, INVENTED BY M. GANNAL.

(As translated in the Journal of the Franklin Institute.)

The difficulties which are known to exist in the manufacture of white lead by the processes now in use, and the dangers to which the workmen employed in it are exposed, determined me to undertake a series of experiments, in order to discover a process more simple and without danger to the workmen.

I feel truly happy in being able to announce to the Academy that I have succeeded in my attempts. *By a process extremely simple, in a very short time, without any danger*, I manufacture any quantity of white lead that commerce may require, and my product will bear comparison with the most perfect that is made.

Among the chemical and mechanical processes thus far known, for the manufacture of white lead, not one appeared to me to combine the conditions necessary to obtain this product with economy and without great danger to the workmen.

A patent taken out in 1834 by Mr. Walker Wood, points out a method, some parts of which, indeed, seem to be new; but the descriptions of this patent are so obscure, and at the same time so erroneous, that I have not thought it worth while to dwell on it.

The following is the description of the manner of proceeding, by which I arrived at a good result:—

A hexagonal or octagonal leaden cylinder is to be prepared, two metres in length, with a diameter of from thirty to forty centimetres. The lead should be from five to eight millimetres in thickness. This cylinder is to he enclosed in a frame made of rod-iron; to one end of which a crank is to be attached. It is to be placed on a stand, so as to receive with ease a rotary movement.

At the centre of the cylinder there is to be an opening or bung-hole through which the materials are to be introduced. At the end opposite the crank and in the axis of the cylinder, another opening is to be made, of from three to four centimetres in diameter, through which is to pass, without closing or stopping it up, an elastic tube fitted to a bellows. This tube must reach the bottom of the cylinder.

100 killogrammes of granulated lead and thirty litres of water are to be introduced into the cylinder; the bung-hole is to be closed, and the apparatus is ready to operate. In this state, if the lateral opening is closed, and the apparatus turned round at the rate of forty-five or fifty turns per minute, and if this motion is continued for five hours, about two-thirds of the lead will be found reduced to an impalpable powder and still retaining its metallic colour.

If the lateral opening remains open, then the lead so divided becomes oxidated, and the product taken out is a protoxide, or massicot, hydrated in part.

Lastly, if an elastic tube reaching to the bottom of the cylinder is fitted to the apparatus, the other end of which is attached to the bellows receiving air from a close chamber or enclosure in which there is burning charcoal; the finely divided lead coming in contact with the air and the carbonic acid blown into the apparatus by means of the bellows, is converted into oxide, and finally into carbonate of lead or white lead.

Acting on this principle, we manufactured a considerable quantity of a product, which was judged to be equal in quality to the best of that met with in commerce.

When the cylinder has been turned for a sufficient length of time, the bung is to be opened, and the liquid contained suffered to run out; a quantity of water equal to that first introduced, is put in, the cylinder is to be turned for five minutes, this second portion of liquid is to be run off, then the apparatus may be immediately re-charged for a second operation, introducing, however, only seventy-five killogrammes of lead, inas-

Digitized by Google

much as there remain twenty-five to thirty killogrammes not finely divided.

In order to facilitate, and hasten the operation, we have made use of two different processes. The first consists in pouring into the water, at the moment of charging the apparatus, 500 grammes of nitric acid. The second in substituting for the acid one killogramme of nitrate of lead.

It is, however, to be remarked, that during the operation a little nitrous acid is disengaged, and that when the operation is completed, scarcely any is to be found in the mixture that remains. I have observed that the acid or the salt of lead is decomposed. A sub-hyponitrite is doubtedless formed, which is afterwards decomposed by the carbonic acid.

The liquid product, withdrawn from the cylinder, is poured into a vessel containing eight or ten times the proportion of water made use of in the operation. This mixture, violantly agitated, becomes considerably whiter, in proportion to the blue tint of the product taken out of the cylinder, which is occasioned by a quantity of lead, finely divided, but not yet oxidated; or yellowish, if formed of oxide not carbonated.

It is to be observed, that after two days washing, the whole of the product is of the most dazzling whiteness. However, I would here observe, that having dried immediately some white-lead which still contained about one-eighth of its weight of divided and non-oxidated lead, at the end of two months the entire mass had a homogeneous tint.

As in this operation some portions of granulated, and others of imperfectly divided lead, escape from the apparatus, it is necessary to let them deposit in vessels having openings at different heights. In the first place the clear water which floats above the deposit is drawn off, then by an opening somewhat lower down, the pasty deposit, which rests on the imperfectly divided particles of lead.

The pasty mass is thrown on filters of closely woven cloth, which have been previously fixed on frames. Here a large quantity of water drains off and leaves a plastic residuum. In this state, the filters are taken down, the ends of the cloth are folded over, and the whole is subjected to a violent pressure.

When this pressure has removed the greatest quantity of water possible, the packets are taken out, the cloths are taken off, the mass is divided into pieces of the desired form, and they are then placed in a hot air stove.

As may be seen, the theory of this operation is as simple as its manipulation. In adopting this system of manufacture, we have *simplification of labour, a larger product, saving of manual labour, and less chance of loss.*

Until the present period, our manufacturers, followers of blind routine, imitated the form which the Hollanders formerly gave to this article; but now, our workmen, our foremen are too well informed to pay any attention to the particular form or shape that may be given to a product. And when they learn that the adoption of this new form or shape has for its principal object the preservation of the health and life of many thousands of fathers of families, who annually perish in consequence of the fatal results of the present mode of manufacture, they will doubtless applaud the intention of my publication, and will hasten to call for white lead in a new form.

To sum up the whole, my process of manufacture consists:—

1st. In granulating the lead.

2nd. In reducing it into indefinitely fine particles by friction on itself in a leaden cylinder.

3rd. In facilitating the oxidation of the lead so divided by the introduction of atmospheric air into the apparatus.

4th. In *carbonating* immediately this oxide of lead by making use of air more charged with carbonic acid.

5th. In hastening the oxidation of the lead, by introducing into the apparatus nitric acid, or the nitrate of lead.

6th. In washing the product obtained by this process.

7th. In hastening its desiccation, by subjecting the result to the greatest possible pressure.

8th. In dividing by square points the pressed mass.

9th. In drying in a hot-air stove the divided product.

On the 24th of December, 1839, a room and the closet of an apartment still occupied by M. Mequignon, Jr., rue des Grands Augustes, No. 9, were painted by Mr. Coulon with white lead manufactured by me by this process; this paint, after four years, is as beautiful as when it was first applied.

The publication now made is entirely for the benefit of the workmen. The manufacturers will hasten to adopt it; but I think, moreover, that taking into view public health, the government ought immediately to interdict the method of making it by putting the lead into pots, which is the principal source of the painters', or lead cholic.

Note.—1 metre = 39·37 inches; 1 centimetre = ·3937 do.; 1 millimetre = ·0397; 1 kilogramme = 15434 grains; 1 litre = about 1 quart.

Digitized by Google

REMINGTON'S AERIAL BRIDGE.

Among the various sights and wonders which have attracted so many thousands to the Surrey Zoological Gardens during the present season, another has just been added, which bids fair to become an object of much interest, not only to the sight-seers of the metropolis, but to the scientific man and the practical machinist and engineer. The patentee of this new wonder, which has been appropriately enough termed "The Magic Aerial Bridge," is Mr. Remington, a native of Alabama, in the United States, who has for many years devoted himself to the perfecting of various useful and curious mechanical inventions; and one of his bridges, which we are about to describe, is, we understand, already in practical operation at Washington. Across the sheet of water which runs at the back of the orchestra, Mr. Lowe, the master carpenter at the gardens, has constructed, under the superintendence of Mr. Remington, a bridge, perfectly unique in its structure and appearance, and as light and fragile as the flying bridges thrown by the Peruvian Indians across the chasms of the Cordilleras. On either side of the water-way a stout buttress of timber, about eight feet in height, is erected, and on these buttresses, stretching across the water-way, a distance of 84 feet, are laid four laths or stringers, of common deal, tapering from about double that thickness to *one inch square*, in the centre of the water-way, where the greatest strain and pressure might reasonably be expected. This constitutes the bridge previously to the footway being laid on; and the public will naturally be as incredulous as we were ourselves when they are told that these four slight-looking laths, of ordinary brittle deal, glued together in several places to obtain the required length, and which seem likely to snap with their own weight, will support a very considerble burden. The foot-tread is formed of slips of deal, glued across the longitudinal stringers; there is no central support, or intervening braces, either from above or below; and yet over this slight and aërial structure we yesterday saw 13 or 14 stout men march at once, without fear or hesitation, although a stranger, witnessing the experiment for the first time, will naturally feel nervous at seeing the frail support bend and sink like a half-tightened rope, as the weight vibrated along the bridge. Mr. Remington assures us that three or four times the number of persons who crossed it yesterday, may venture upon it at once with the most perfect safety, and that there is no practical limit to the length of the bridge. The "magic" of the structure and the novelty of the principle consist in the application of the longitudinal fibre of the wood, so that every portion is brought at once into play, and supports an equal share of the strain. The rapidity with which such a bridge can be constructed, and the comparative insignificance of the cost, are among the obvious advantages of the invention, and we have no doubt it will attract the attention and consideration of the scientific world. *Morning Herald.*

THE TURKISH STEAMER "VASSITER TIDJARET." — (PATH OF COMMERCE, OR PATH-FINDER.)

Our last advices from Constantinople announce the arrival at that port of the new steam-ship, the *Vassiter Tidjaret*, after having performed the voyage from Plymouth in the short space of 12 days, allowing for the time occupied by her detention at Gibraltar, Malta, and Smyrna.* This vessel was built expressly for the Turkish government by Messrs. F. and J. White, of Cowes, and is of the burden of nearly 1,000 tons, having a pair of Messrs. Maudslay's engines, of the collective power of 300 horses. Her arrival produced quite a sensation amongst the native and European population, who crowded from all parts to see her elegant form as she lay on the blue waters of the Golden Horn. The Sultan, who, since his accession to the throne, has been prominent in encouraging the extension of steam navigation in his empire, as one of the means most conducive to its welfare, and best calculated to promote the spirit of reform with which he is inspired, made an excursion on board the *Vassiter Tidjaret* in the sea of Marmora. After a run of a few hours, during which his Imperial Majesty examined minutely every part of the vessel, he expressed himself highly gratified with her performance, both as to speed and the easy working of her engines. Great praise is due to Mehmed Ali Pasha, the late High Admiral of the Turkish empire, who, with an intuitive sagacity and earnestness of purpose but seldom evinced by his predecessors, has been mainly instrumental in carrying out the liberal views of his sovereign; as during the two years of his administration of the naval affairs of the country, he toiled hard, and succeeded in eradicating abuses which were a barrier to all improvement, and left the arsenal better provided and better regulated than it had been for years before. Turning more particularly his attention to the steam navy, Mehmed Ali Pasha saw the imperative necessity of creating one more efficient to compete, in case of need, with the numerous fleet of steamers that, under a rival flag, plough the waters of

Digitized by Google

the Black Sea. During his administration two first-rate steam frigates, of 450 horses' power each, have been launched from the dockyard of Constantinople, and two others of the same power have since been placed on the stocks, and the engines ordered from England. It is to be hoped that the Turkish government will follow up the stimulus thus given to its steam navy, the importance of which must and ought to be fully appreciated.—*Times.*

THE ATMOSPHERIC RAILWAY SYSTEM.—ANOTHER DAMPER.

A meeting of the South Devon Railway Company was held on the 27th Aug. last. The report stated that no part of the line had yet been opened with the atmospheric apparatus, and that all that had been yet done, was to make some experiments between Exeter and Teignmouth. Mr. Brunel, the engineer of the line, stated in reply to a question from a shareholder, that it was, however, the intention of the directors to open the atmospheric line as early as possible to Teignmouth, and thence proceed to Totnes soon after, unless it should be found the line would be ready to Totnes shortly after they were ready to proceed to Teignmouth, in which case they would wait till they could open all the way to Totnes. Thereupon

Mr. HUDSON rose, and spoke to the following effect:—"He attended as representing an important Company, who had a large interest in the undertaking, and who were anxious for its success. He had himself been over the line; he had seen its capabilities, and he was quite convinced that, if it were managed judiciously, it would yield a fair dividend to the shareholders; but it was not a line which could afford to spend the shareholders' money in experimental undertakings. For one, he regretted that the Company should be involved in such experiments; still, as they had gone so far, it was due to the public, due to the inventor, that the system should be fairly tried; and he hoped that no time would now be lost in having the locomotives removed, and putting a power of *alleged* greater tractive force upon the rails. But, even supposing the new principle were of greater tractive power, still it would be necessary to see whether it could be rendered commercially useful. The expenses which had already been incurred upon this principle, amounted to about 10,000*l.* per mile; *and he feared the expense would ever be a vital objection to its adoption.* * * * He repeated, that the line, if fully worked, and the traffic were fully developed, would pay a fair dividend; but if they went into expenses of an extraordinary kind, then he must say he looked upon it with great doubt; *and he thought there were no means equal to their present means of propelling trains.* He hoped, therefore, the board would *determinedly resist any further outlay of capital in this direction* until they obtained a report, carefully drawn up, both as to the expense and the power of this new principle, and, at the same time, comparing it in both respects with the means of traction now in use."

The suggestion with which Mr. Hudson concluded, may be considered as amounting simply to an invitation to the advocates of the atmospheric system to answer, if they can, Mr. Robert Stephenson's work on the subject, published now more than two years ago, in which he demonstrated the great inferiority of the system (as far as hitherto developed), in every point of view, to the ordinary locomotive plan. It is a work which, though much carped at, has never yet been grappled with.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 239.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

Henry Ould, of Dartmouth, mathematical instrument maker: of a new improvement of the Hadley's quadrant and sextant, being an apparatus or instrument to be affixed thereto at pleasure, whereby a true, just, or effectual horizon can be artifically obtained, notwithstanding the real or natural horizon should be prevented from being seen by the interposition of land fogs or thick weather. Cl. R., 32 Geo. 3,, p. 1, No. 13. Dec. 17, Jan. 16, 32 Geo. 3, 1792.

James Peacock, of Finsbury-square (Middlesex), architect: of "a new method for the filtration of water and other fluids" applicable to heads of water of various magnitudes or extents for public service, reservoirs, or cisterns for private use, by impelling the ascent of the fluid through the filtering medium instead of the common meth by descent. Cl. R., 32 Geo. 3, p. 1, No. 11. Dec. 23, 32 Geo. 3; Jan. 21, 1792.

Anthony George Eckhardt, of Chelsea, manufacturer: of an invention of laying on or imprinting grounds or coats of composition or painting upon satin, silk, cotton, linen, velvets, leather, or any kind of cloth,

Digitized by Google

stuff, or paper, for the receiving impressions of engraved copper plates in all sorts of colours, and for other purposes. Cl. R., 32 Geo. 3, p. 1, No. 2. Jan. 16, 32 Geo. 3; February 16, 23 Geo. 3, 1792.

Francis Spilsbury, in the parish of Saint Ann, Westminster, chemist: of an invention of a certain medicine, called Spilsbury's Antiscorbutic Drops, which has proved an efficacious remedy for eradicating the most inveterate scorbutic disorders. Cl. R., 32 Geo. 3, p. 1, No. 1. Feb. 4, 32 Geo. 3; Feb. 22, 32 Geo. 3, 1792.

James Tate, of Oxford-street, ironmonger: of "an invention of a machine with utensils for cooking on improved principles," consisting of different improvements in the mode of cooking by and from an inclosed fire-place or furnace, the principal feature whereof is the application of a boiler for raising steam to cook with, but which may also be applied to other useful purposes, such as warming rooms. Cl. R., 32 Geo. 3, p. 2, No. 3. March 2, 32 Geo. 3; March 31, 1792.

Charles William Ward, of Hatton-garden, gent.: of a method of changing the smoke or vapour arising from the combustion of many kind of substances into various useful materials according to the substances burnt. Cl. R., 32 Geo. 3, p. 2, No. 1. March 15, 32 Geo. 3; April 13, 1792.

Andrew Primerose, of Lambeth, gardener: of a new method of manufacturing all sorts of feathers into men and women's hats, head-dresses, muffs, tippets, and shoes. Cl. R., 32 Geo. 3, p. 3, No. 12. May 3, 32 Geo. 3; May 7, 32 Geo. 3, 1792.

Joseph Manton, of Davies-street, (Middlesex), gun maker: of a hammer on an improved principle for the locks of all kinds of fire arms, and also an improved breech for all kinds of double and single barrelled guns and pistols. Cl. R., 32 Geo. 3, p. 4, No. 16. April 18, now last, 32 Geo. 3; April 17, 1792.

John Collinge, of Buxton-place, Lambeth, wheel box and axle tree maker: of "an invention of and improvement in and upon carriage and other wheel boxes and axle-trees," the great excellence of which invention consists in the superior principle of its motional parts, in conjunction with the provisions which are made for a copious supply of oil and a protection from the access of dirt, &c. Cl. R., 32 Geo. 3, p. 4, No. 1. July 17, 32 Geo. 3; August 17, 32 Geo. 3, 1792.

James Davis, Tottenham-court-road, organ builder: of "an entire new improvement upon several musical instruments, called Pianofortes and Harpsichords." The improvements upon the pianoforte and harpsichord consist in combining both these instruments together, and in having them nearly in the same compass as one. The pianoforte has one row of keys for its own action, and the harpsichord has also one row of keys for its own action. The upper row of keys is for the pianoforte, and the under row of keys is for the harpsicord; so that when a person plays either of these rows, he plays either a complete pianoforte or a complete harpsichord. Cl. R., 32 Geo. 3, p. 5, No. 6. June 6, 23 Geo. 3; July 5, 1792.

Joseph Manton, of Davies-street, gunmaker: of "a trigger on an improved principle, for all kinds of double and single-barrelled guns and pistols, also an improved wadding for all kinds of guns and pistols." The utility of the triggers is in their being kept close to the sear of the lock by the spring, which prevents the trigger from shaking, and causes it to sound against the frames the same, let the gun be held in any direction whatsoever. The utility of the wadds is to keep the shot in the centre of the bores of guns, and thereby prevent the shot from rolling, striking the sides, or injuring the bores thereof: they may be applied to all kinds of guns from the forty-two pounder to a musket; will have a very good effect in throwing shells, &c. Cl. R., 32 Geo. 3, p. 5, No. 2. July 5, instant, 32 Geo. 3; July 24, 32 Geo. 3, 1792.

James Rumsey, of Falcon-stairs (Surry), engineer: of "certain new methods of raising water and other fluids, or applying their force to the purposes of milling, or giving advantageous motion or effect to various machines and engines," consisting of the following general principles, forms, and properties, viz.: 1. In being capable of great variations in their forms and constructions, without thereby departing materially from their uniform principle, or receiving or communicating their force in the manner of an inclined plane. 2. In being capable, as circumstances may require, of acting either as agent or instrument in producing or giving advantageous motion to various kinds of machines. 3. In having the ability, when acted upon by heavy fluids, such as water, of communicating their force with advantage and simplicity to give power full motion to many kinds of machines. 4. In being capable, when fixed upon boats or vessels when floating upon water, of giving them powerful motion by the aid of horses, wind, or steam, or any other power applied thereto. 5. In constructing these machines in some cases, so that the water as it passes through the machines exerts both its action and reaction to give motion and force to the object

Digitized by Google

to be moved. 6. In being so formed as to work without inconvenience in backwater, or with uniform power and motion by the tide (or any other water), notwithstanding it may be continually varying its height. 7. In forming wheels for some objects, by fixing round their axis a spiral projection or fan of metal or wood in form of a screw, something similar to that of Archimede's Pump, against the spiral projection or screw, and in the direction of its axis (which may be elevated to any suitable degree), the water is brought to act; by which means it will give motion and force to the machine in proportion to the weight of the fluid expended, and the time and distance of its descent. 8. In some cases the construction of the machines for raising water or other fluids (by the application of any external force to give them a rotary motion), consists simply of a hollow axis of the height that the water is to be raised, which has at its bottom a pivot and valve (similar to those of the centrifugal pump): on the top of this hollow axis is placed a hollow wheel, out of which (when the machine is put in motion) the water issues from apertures at its opposite sides. This machine, with but little variation, besides being inverted, and causing the water from a fall to pass through it, becomes a powerful mill. Cl. R., 32 Geo. 3, p. 7, No. 13. July 24, 32 Geo. 3; Aug. 23, 32 Geo. 3, 1792.—(*To be continued.*)

NOTES AND NOTICES.

American War Steamers.—By a late Act of Congress, four war steamers are directed to be built; two first class, of 2,414 tons burden, and two second class, of 1,379 tons.

Dimensions of First Class.

Between perpendiculars	250 ft.	0 in.
Beam, extreme.....	45	0
Depth to gun-deck in hold	26	6

Second Class.

Between perpendiculars	210	0
Beam, extreme	27	0
Depth to gun-deck in hold	23	0

The two first-class steamers, and one of the second class, to be propelled by side wheels; the fourth by a screw propeller.

One of the largest class is to be built at Gossport, and one at Philadelphia; one of the second class at New York, and one at Kittery, Maine.

A New Effect of the Magnetic Telegraph.—The various wires of telegraph beginning to intersect so many sections of our country are said to have a decided effect upon electricity. That eminent scientific man, Professor Olmstead, of Yale College, states, that as the storm comes up, and especially when over the wires, say 50 or 100 miles distant, the lightning is attracted by the wires;—which can be proved by any one remaining in the Telegraph-office for half an hour. About the time the storm is coming up, the wires are continually filled with electricity. "It is my opinion," he says, "that we shall never have very heavy thunder showers, or hear of lightning striking, so long as we have telegraph wires spread over the earth.—*American Paper.*—According to this we should long ago have ceased in such a city as London to have any experience of such a thing as a thunder storm; for what are all the telegraphic wires that have yet been erected, or that ever will be erected in any country in the world, to the prodigious quantity of iron rails and posts contained within any square mile of this vast aggregate of iron-fenced houses and streets? Professor Olmstead's ideas on this head are much at variance with those entertained by other men of science. Professor Leslie quite derides the idea of any non-conductor exerting an attractive influence at a distance of even fifty or a hundred *inches*.

LIST OF ENGLISH PATENTS GRANTED BETWEEN SEPT. 6, AND SEPT. 9, 1847.

John Mitchell Rose, of the firm of Rudall and Rose, Tavistock-street, Covent-garden, musical instrument makers, for certain improvements in flutes, clarionets, and other similar wind instruments. (Being a communication.) September 6; six months.

Henry Vint, of St. Mary's Lodge, Colchester, gent., for improvements in propelling ships and other vessels. September 6; six months.

John Burke Gustavus Ferryman, of Cheltenham, gent.; for certain improvements in handles to be applied to various articles for containing liquids, or other matters liable to be spilt. September 6; six months.

James Leadbetter, of Over Darwin, Lancaster, brazier, and William Pierce of the same place, mechanic, for certain improvements in machinery, or apparatus, for raising water and other fluids. September 6; six months.

Thomas Marsden, of Salford, Lancaster, for improvements in machinery for dressing or combing wool, flax, and other fibrous substances. September 6; six months.

Joseph Clinton Robertson, of 166, Fleet-street, London, C. E., for certain improvements in the manufacture of metals from their ores. September 9; six months.

James Sims, of Redruth, Cornwall, civil engineer, for certain improvements in steam engines. September 9; six months.

William Brockedon, of Devonshire-street, Queen's-square, Middlesex, gent., for improvements in heating rooms or apartments. September 9; six months.

Connor William O'Leary, of Tralee, Kerry, Ireland, for certain improvements in the methods of producing power for the discharge of weapons and missiles, and other purposes. September 9; six months.

Thomas Battye, of Woburn-place, Middlesex, gentleman, for an improved mode of retaining the waist of the human body in a desirable form, without producing the inconvenience resulting from the tight lacing of stays or corsets, or buckling of belts, waistbands, or girdles. September 9; six months.

Clemence Augustus Kurtz, of Manchester, manufacturing chemist, for certain improvements in the mode of preparing and using indigo in the dyeing and printing of woollen, cotton, and other fabrics. September 9; six months.

William Gibbons, of Corbyn's Hall, Worcester, for certain improvements in trussing beams and girders. September 9; six months.

John Blyth and Alfred Blyth, of Saint Anne, Limehouse, Middlesex, and John McCulloch, of Masemore Cottages, Old Kent Road, Surrey, for certain improvements in apparatus for distilling and rectifying. September 9; six months.

Frederick Steiner, of Hyndburn Cottage, near Accrington, Lancaster, for improvements in the manufacture of sugar. (Being a communication.) September 9; six months.

James Pitt, of Cheyne-walk, Chelsea, gentleman, for improvements in apparatus for holding down trousers. September 9; six months.

Digitized by Google

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Sep. 3	1185	Smith and English.....	Princes-street, Haymarket.....	Spanner, or wrench.
„	1186	Richard Farrar	25, Great Russell-street, Covent-garden	Office invoice, letter, and leaf-binder.
4	1187	John Baldwin Wheeler and John Lee Abiett.....	Poultry, London	Solatium stocking, or stock.
6	1188	Thomas Shutt Stock ...	Birmingham.....	Garden, or fire-engine.
„	1189	William Stalte.....	Radford Semele, near Leamington	Surface, or skim plough.
7	1190	Joseph Fenn	105, Newgate-street.....	Eccentric lever brace.

Advertisements.

Viaducts and other Railway Work.

THE attention of Railway Engineers, Architects, and Contractors is particularly directed to the great advantages to be derived from the application of SEYSSEL ASPHALTE, as the *only impervious* and *permanent* covering for arches and roofs, and lining of reservoirs, gutters, &c. The arrangements of CLARIDGE'S PATENT ASPHALTE COMPANY enable it to execute works of any extent with the greatest promptitude.

In order to guard against the use of spurious materials, it is important that all applications for works to be executed be made direct to this Company; and, as a further protection, it is suggested that Engineers, Architects, and Contractors should require a CERTIFICATE from the Company that the proper description of material has been used.

Information may be obtained as to all works which have been executed by the Company since its establishment in 1838, which will prove that the failure of many works represented to have been done with the genuine material has resulted from the substitution of a spurious one.

I. FARRELL, Secretary,
Seyssel Asphalte Company, Stangate, London.

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings, and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Patent Bells.

MESSRS. MEARS beg to call the attention of the Trade and the Public generally to these articles, which they are now prepared to supply in any quantity and variety. The composition is of a new metal, called the Union Metal, and the bells are of very beautiful tone, and cheaper than those made of the ordinary bell metal. Orders received at the Bell Foundry, Whitechapel, for house, cattle, and other bells.

Just published, second thousand, Vol. II.

Turning and Mechanical Manipulation.

By CHARLES HOLTZAPFFEL, A. Inst. C. E. &c.

THIS work is intended for general reference and practical instruction on the Lathe, and the various mechanical pursuits followed by Amateurs. To be comprised in six volumes.

Vol. I.—(Second Thousand)—On Materials, their differences, choice, and preparation, various modes of working them generally without cutting tools.
Octavo, cloth, pp. 462, and 315 woodcuts.
Price 15s.

Vol. II.—(Second Thousand)—On the Principles of Construction, Action, and application of Cutting Tools, used by hand: namely, chisels and planes, turning tools, boring tools, screw-cutting-tools, saws, files, shears, and punches; and also of machines derived from these hand tools.
Octavo, in cloth, pp. 562, and 711 woodcuts.
Price 28s. In the press.

Vol. III.—On Abrasive and Miscellaneous Processes, which cannot be accomplished with Cutting Tools.

Vol. IV.—On the Principles and Practice of Hand or Simple Turning.

Published by Holtzapffel and Co., engine, lathe, and tool manufacturer, 64, Charing-cross, and 127, Longacre, London; and to be had of all Booksellers.

The Prospectus, with Table of Contents, free by post.

Enfeebled Hands.

HOLTZAPFFEL and Co.'s PEN-HOLDER for ENFEEBLED HANDS.—Registered September 16, 1846.—This instrument was invented by the late Mr. CHARLES HOLTZAPFFEL, for the use of those persons who, from age, rheumatism, gout, stiffness in the joints of the fingers, paralysis, or infirmity, are deprived of the free use of the fingers, so that they cannot hold a pen in the customary position. The Pen-holder is adapted to receive a gold, steel, or quill pen, at the option of the individual, and the instrument may be carried in the pocket, as it folds into the size of an ordinary pencil-case. Instructions for using the pen for enfeebled hands, with a diagram, sent free by post, on application to HOLTZAPFFEL and Co., engine, lathe, and tool manufacturers, 64, Charing-cross; and 127, Longacre, London.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are, that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

CONTENTS OF THIS NUMBER.

Description of Messrs. Fossick, Hackworth, and Elliott's Patent Improvements in Locomotive and other Tubular Boilers—(*with engravings*) 241
On Aërial Navigation. By J. Pitter, Esq. 243
On Yacht Sailing. By John MacGregor, Esq. 244
Remarks on the Use of Mathematical Knowledge to Engineers, and Hints to those who have not the Benefit of a Tutor—(*concluded*) 245
Mr. Bashforth's Earth Table 249
On Railway Buffers. By Owen Rowland, Esq. 249
The New Planet, Neptune—American Observations 250
Transit of Mercury across the Sun, May 18, 1845, at the Precise Instant predicted by Leverrier 252
The "Great Britain"—The Truth Confessed... 253
The Dundrum Bay "Triumph of Engineering" 256
Velocity of the Electric Current..... 256
Adcock's Spray Pump 256
Description of Gannal's New Process for Manufacturing White Lead 257
Remington's Aërial Bridge..... 259
The Turkish Steamer "Vassiter Tidjaret"—(Path of Commerce, or Pathfinder)..... 259
The Atmospheric Railway System—Another Damper..... 259
Calendar of Specifications—(*continued*)..... 260
American War Steamers 262
A new Effect of the Magnetic Telegraph..... 262
Weekly List of New English Patents 262
Weekly List of Articles of Utility Registered. 263
Advertisements 263

NOTICE TO CORRESPONDENTS.

We are waiting the receipt of some letters, with which Mr. Craddock has kindly promised to supply us, before concluding the series of articles on his steam-engine improvements.

Communications received from C. C. T.—Argus.—J. Ainsworth.—V.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 165, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1258.] SATURDAY, SEPTEMBER 18. [Price 3d.

Edited by J. C. Robertson, 166 Fleet-street.

MR. CRADDOCK'S PARALLEL DOUBLE-CYLINDER LOCOMOTIVE.

Fig. 1.

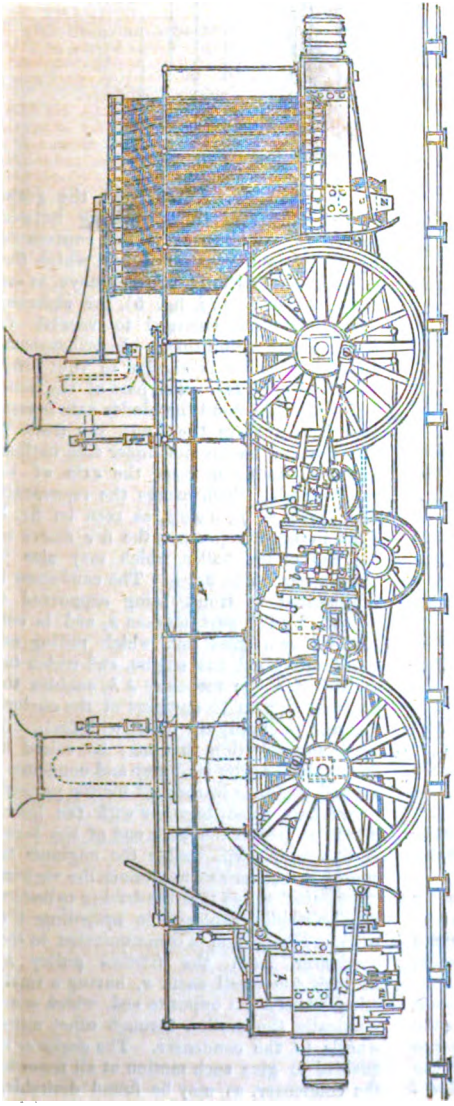
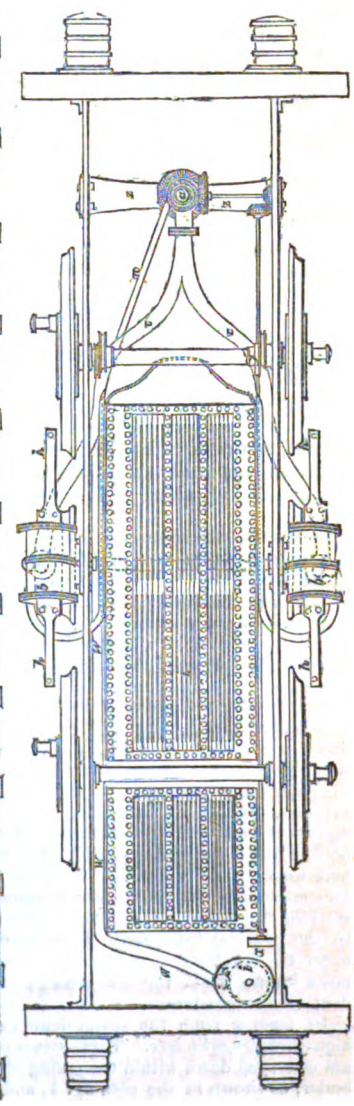


Fig. 2.

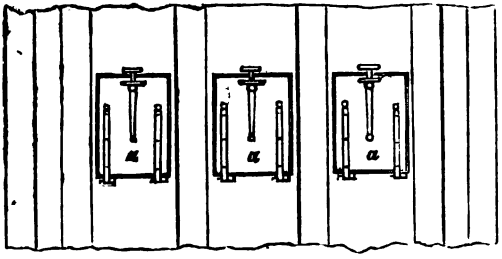


Digitized by Google

MR. CRADDOCK'S PARALLEL DOUBLE-CYLINDER LOCOMOTIVE.

(In continuation from page 125.)

Fig. 7.



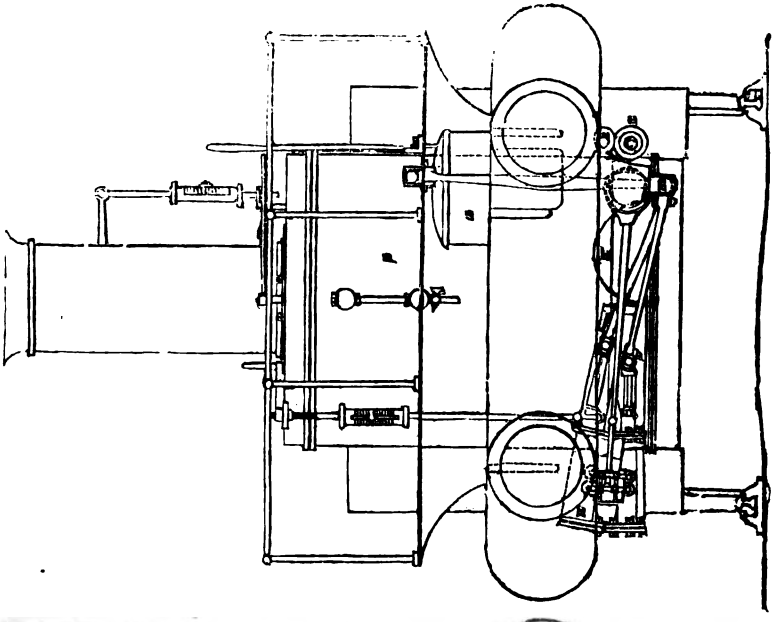
We now proceed, in conclusion, to show the application of Mr. Craddock's steam-engine improvements to railway purposes. Mr. Craddock describes two double-cylinder locomotives constructed according to his views—one in which the cylinders are placed parallel to one another, as usual; and the other in which they are set angularly, as described in the first of this series of notices. It may suffice to give his description of the former, as the peculiarities belonging to the latter are easily deducible from the change in the position of the cylinders:

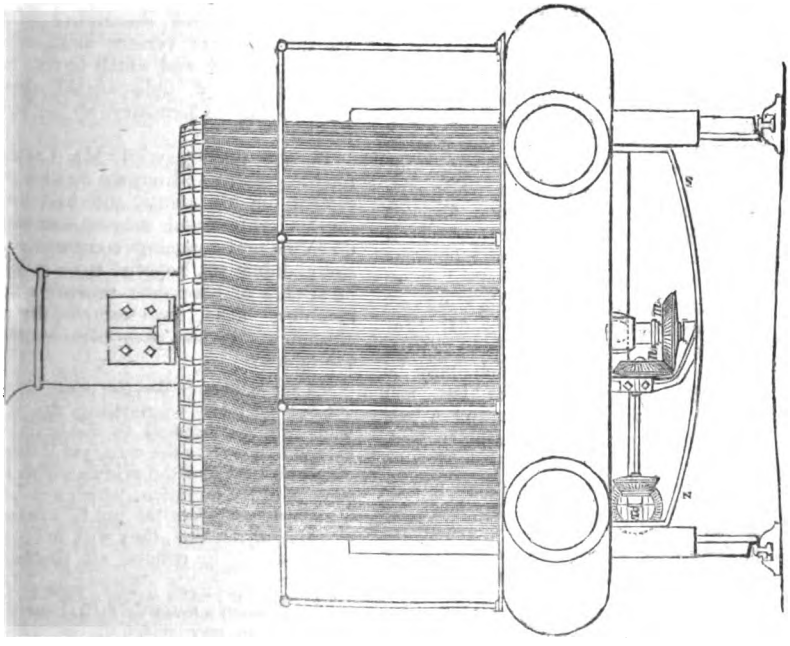
Figure 1 of the accompanying engravings is a side elevation of a parallel double cylinder locomotive. Fig. 2 is a plan; fig. 3 a view of the front end; fig. 4 a view of the back end; fig. 5 a section right across the cylinders; and fig. 6 a sectional elevation through the centre of the condenser. Fig. 7 is a plan of a portion of the top of the boiler, showing the means of feeding it.

P is the boiler; *a* the high-pressure cylinder, and *b* the low; *h h h h* the guides; *e* the high-pressure piston, and *f* the low; *c* the connecting rod from the high-pressure cylinder, which takes hold of the hind driving wheel; and *d* the connecting rod taking hold of the front driving wheel. The valve here used is the same as that described in a former number (p. 170). The motion for working the valves in this engine is obtained in the usual manner, from the eccentrics *j* upon the front axle. *v v* are the exhaust pipes leading from the low-pressure cylinders to the condenser. *u u* are the steam pipes leading from the steam dome to the high-pressure cylinders. These steam pipes are conveyed down within the casing of the boiler, as shown in the plan fig. 1, and at *l* in the elevation fig. 5. The parts, marked *i* in the plan fig. 1, represent the grates, having ranges of tubes running between them. The flue space is that represented by the two outer rows of tubes, which flues communicate with the two chimneys, as seen in fig. 2 (see also *j j*, fig. 5), the chimneys being somewhat enlarged to receive the steam chests within them. In principle and action this boiler is similar to that before described (p. 124). The part of the boiler which stands behind the hinder axle is separate from that in the front, the front or larger boiler having its under side inclined upwards, so as to clear the axle of the small wheels, which causes the representation shown at *g g g g g*, as seen in fig. 5. *a a a* in fig. 7 represent the fire doors on the top of the boiler, which may also be seen in section in fig. 5. The condenser is represented in front, being supported at bottom by the part marked *z*, and is surrounded by a hand rail, which railing extends all round the engine, and which together with the foot way *k k*, enables the engineer to pass to any part of the engine, and also to supply the boiler with fuel. To meet any objection that may be raised to the working of the air-pump and condenser, a small engine is introduced for the purpose of working them, together with the boiler pump, as seen at the back end of the locomotive, which will enable the engineer to supply the boiler and to produce the vacuum before starting, so that the driving cylinders may be wholly employed in propelling the train. The motion is communicated to the condenser from the friction pulley *x*, through the small shaft *x*, having a small mitre wheel at its opposite end, which communicates the motion through other mitre wheels to the condenser. The engineer is enabled to give such motion at all times to the condenser, as may be found desirable, through the friction pulley *x* and the lever

Digitized by Google

Fig. 4.





Digitized by Google

x, which is acted on by the winch at the top of the spring balance (see fig. 4), thereby bringing the pulley *x* into contact with the pulley *q* (which last should have been represented on the small engine shaft); in which case it will be seen, that as more or less pressure is thrown on the pulleys, the condenser will be driven faster or slower, as may be required, whilst the spring balance will indicate the amount of power at any time required to drive it. *i* represents the air-pump; *m* the crank shaft of the small engine; *w* is the pipe which leads from the bottom of the condenser to the air-pump. The steam from the exhaust side of the low-pressure cylinder passes up the central pipe *f* into the part marked *b*. The manner in which the revolving joints of the condenser are constructed has been before described (p. 100).

In fig. 5 we have a different view of the boiler to anything before described, which shows the fire box extending up a little way above the letters *p*, whilst *j j* are the hot-air flues, *i i* the casing, which is supposed to have some non-conducting substance between it and the boiler; whilst the steam pipes *l l* are seen as passing out from between this casing and the boiler to the high-pressure cylinders *a a*; *b b* are the low-pressure cylinders; *y y* represent the valves.

The most striking peculiarity in this engine is, that it has *no blast;* and this, with many, will be considered at first sight as an insuperable objection to it—seeing that, according to Pambour, the quantity of steam generated in any given time without the blast, is but *one-fourth of that produced with the blast.* But let us see how Mr. Craddock, while candidly anticipating this objection, disposes of it. He shows, by calculations which seem accurate enough, that in a locomotive on the plan before described, there are five and a half times more heating surface than contained in one of Mr. Stephenson's narrow gauge engines; so that, against the four-fifths, which may be said to be lost for want of the blast, you have to set the four-fifths and a half gained by the increase of heating surface, which brings the two engines nearly on a par in point of steam generative power. Besides, in getting rid of the blast, we get rid at the same time of its re-action on the piston, and of the excessive heat and destruction of metal invariably attendant upon it.

Another prominent peculiarity, but which needs no set-off like the preceding, is, that it is an engine which requires no water tender. The same water being used over and over again, and but a few gallons per day being required to make up for leakage, there is no need of carrying fresh supplies along with the engine.

But no doubt the greatest advantage of all, which Mr. Craddock's locomotive promises, is the large saving which would result from working the high-pressure steam (now used in locomotives) expansively, for which his arrangements offer obviously unwonted facilities. He has been at the trouble to compile a table (A), showing the comparative effect of steam when generated under different pressures, and cut off at different parts of the stroke; and another (B), showing the comparative economy of using steam at the high degree of expansion which he recommends and has provided for, compared with that at which it is now ordinarily employed; from which tables it appears to be pretty clearly made out that the revenue of the railway companies might be increased *a full fifth* by the adoption of his system.* Both of these tables we annex. We extract them from a pamphlet which Mr. Craddock has published this week, descriptive and explanatory of his various steam-engine improvements,† and which forms a useful, and, indeed, indispensable supplement to his "Chemistry of the Steam Engine."

In now parting with Mr. Craddock for the present—which we do with great esteem for his talents, and best wishes for his professional success—we cannot do so without a passing comment on the complaining yet hopeful tone in which he speaks of his public reception as an inventor. Take, for example, the conclusion to his last pamphlet containing the tables:

"I am well aware that the results brought out in these tables are startling, and such as many will be disposed to doubt; but although this may be the case, yet if they will weigh with candour the evidence adduced in support of the invention, which now I trust is as fairly set before the public as ever was anything of the kind, they will find it sufficiently ample to remove all doubts from

* These are the tables (called by an error of the press "letters") referred to in our last week's "Notices to Correspondents."

† Simpkin, Marshall, and Co., 8vo., pp. 40.

Digitized by Google

Fig. 6.

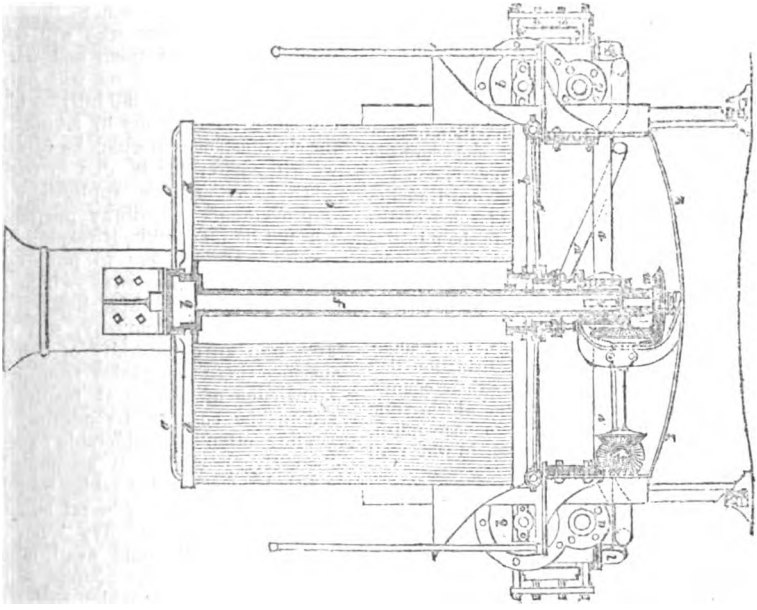
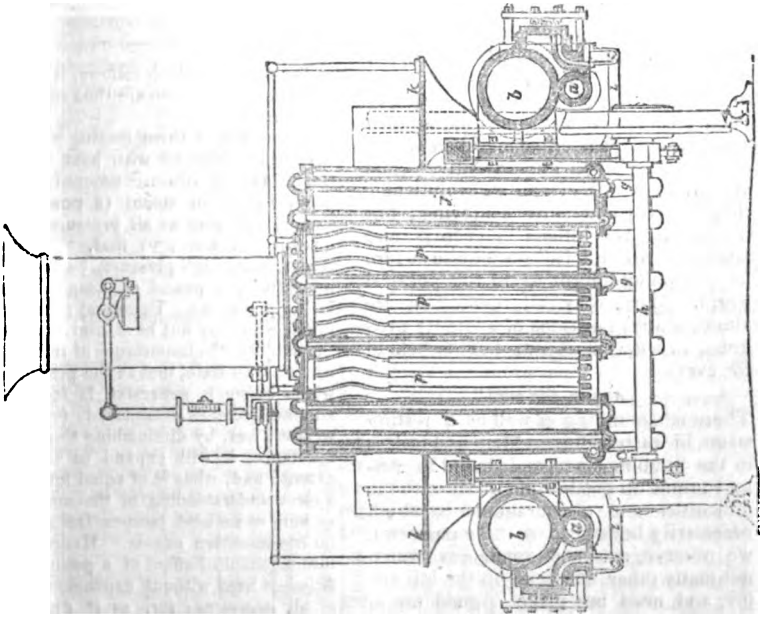


Fig. 5.



Digitized by Google

their minds, if they possess the requisite knowledge of the subject, and that freedom from envy or adverse interests which will permit them to form an impartial opinion. But where the mind is prepossessed with these detracting influences, the history of the world affords too much evidence, that in proportion to the value of anything, and the abundance of proof that it possessed such value, so has been the determination of men thus influenced to obstruct it, and who have thus, to the utmost of their power, opposed the laws of providence, and deprived the mass of mankind for years of some of the richest blessings, in addition to the injustice which they have perpetrated against individuals. From such men I expect no encouragement, but from the most intelligent engineers, from scientific men, and from the multitude of my fellow beings, I still entertain the most encouraging anticipation that they will aid me, at least by their countenance, in accomplishing that which, from first to last, I have desired to accomplish, viz., a great and lasting good, in which all mankind may participate."

Mr. Craddock has not had his inventions as instantly and as fairly appreciated as he would like, and as they deserve. He but shares in this, however, the common fate of inventors—nay, the common fate of all who seek to innovate on existing, and perhaps long-established, practices and usages. He must, like others, bide his time. For as surely as light follows the rising of the sun, so surely must any really new light in science attain, sooner or later, to meridian splendour. People of the inventive class are prone to talk of the "revolutions" they are daily and hourly achieving; but in truth, "revolutions" — actual and positive "revolutions"—are quite as rare in the philosophical as in the political world. What they call revolutions are almost always but steps of a mighty progress, in which it is our fate to behold for ever—

"Alps on Alps arise."

There is a climbing as well as a resting stage in such things. Mr. Craddock is in the climbing stage, and should be content to put up good-humouredly with the difficulties and discouragements which necessarily belong to it. He possesses, we observe, aids and appliances which not many other climbers up the hill enjoy, and need but make a good use of them to be soon left without any cause for complaint. He dates his pamphlets from a large steam-engine manufactory in Birmingham, where he states he has "constructed several engines" on his patented plans, and where they "may be seen" by any one who will take the trouble to inspect them and test their capabilities. Now if he will only take one step more (up the hill)—which he can have no difficulty in taking, under the circumstances in which he is placed—we will answer for it, that in so far, at least, as regards the application of his improvements to railway purposes, he will not be long without reaping his due reward. He has but to put an engine on his plan *on the rail*—which either the Liverpool and Manchester, or the North Western Company, will readily give him an opportunity of doing (we instance these companies from personal knowledge of the great facilities they are in the custom of rendering to inventors, often at considerable expence to themselves)—and if it accomplish but one-half of what his tables would lead us to anticipate, its general adoption is certain. Neither "envy" nor "adverse interests" could avail much, if anything, against the pounds, shillings, and pence argument which such a result would supply.

The table A, which follows, is founded on two principles, which are thus enunciated by Mr. Craddock:

"The first of these leading principles is, that water charged with heat becomes an elastic gas or steam. Secondly, that any given weight of steam (a pound, for instance) contains at all pressures the same quantity of heat; so that, by generating steam under high pressure, we consume no more fuel per pound of steam than we do at low pressures. To convey to the reader's mind, who may not have previously studied the subject, the importance of this fact, it is necessary to state, that as the pressure under which steam is generated is increased, the volume becomes diminished, for any given weight; but, by diminishing the restraining resistance, it will expand to an enormous extent: and, what is of equal importance to a clear understanding of the matter is, that as long as no heat escapes from the steam, no condensation ensues. Hence the absolute mechanical effect of a pound of steam is, when used without expansion, the same at all pressures; for, as it diminishes in pressure, it compensates by its increased volume."

Digitized by Google

... under different pressures, & cut off at different parts of the stroke, as stated under Examples.

EXAMPLES.	Col. 1. Effect without Expansion	2. Effect of expansion due to the density of the steam, or exclusive of that due to it in common with the other gases by increase of sensible heat.	3. Effect due to the dilation of the steam by the increase of sensible heat.	4. Total effect, showing the average pressure throughout the stroke.	5. Showing the relative quantity of coal in lbs. per 1000-horse power; or, by cutting off 3 whole numbers to the right hand, the quantity in lbs. and decimal parts of a lb. per horse-power per hour.	6. Showing the relative quantity of coals in tons required by marine engines equal to 1000-horse power for 336 hours, or the time supposed to be occupied for the voyage between Liverpool and New York.	7. Additional economy effected by the saving of coal in the generating of the steam in the boiler, shown as before (column 5) in lbs. of coal per 1000-horse power.	8. The additional economy produced in the generating of steam in the boiler, represented in tons per voyage, as shown in column 6.
No. 1. On entering the cylinder at 200 lbs. and cut off at $\frac{1}{64}$	200	900	435	23.98	1074	161	767	115
No. 2. Ditto at 100 lbs. and cut off at $\frac{2}{64}$	200	750	310	19.68	1308	196	934	140
No. 3. Ditto at 50 lbs. and cut off at $\frac{4}{64}$ This represents the Cornish system	200	600	215	15.85	1625	243	1160	174
No. 4. Ditto at 20 lbs. and cut off at $\frac{10}{64}$	200	382	112	10-84	2376	356	1640	254
No. 5. Ditto at 15 lbs. and cut off at $\frac{18}{64}$ and $\frac{1}{3}$ of $\frac{1}{64}$	200	328	88	926.	2677	401	1912	286
No. 6. Ditto at 20 lbs. and cut off at $\frac{1}{3}$ This represents the present marine practice.	200	128	76	6.31	4082	612	2916	437
No. 7. Ditto at 50 lbs. and cut off at $\frac{4}{6}$ But working against the atmosphere, as in the common non-condensing engine.	200	87	102	6.07	4243	636	3031	454
No. 8. Ditto at 35 lbs. and cut off at $\frac{3}{4}$ And working against the atmosphere and the resistance of the blast-pipe, as in the locomotive. In this example the steam is supposed to quit the cylinder at 35 lbs. pressure above the atmosphere, or 50 lbs. absolute pressure.	200	62	108	5.78	4456	666	3180	477
No. 9. Ditto at 20 lbs. Without expansion.	200	—	36	3.68	7000	1050	5000	750

Digitized by Google

TABLE (B).

Shows the relative economy in the Locomotive Engine, as brought out by a comparison of Examples Nos. 1 and 2, Table A, when compared with that of No. 8 in Table A.

Note.—The saving as set forth in column 2 is obtained by taking the revenue or traffic account, as shown by the statement of accounts given of the Manchester, Sheffield, and Lincolnshire Railway, for the half-year ending June 30, 1847, in which account the traffic is set down as 51,486*l.*; the cost of coke for such traffic being 2,890*l.* If, therefore, we double these amounts, so as to make them answer for the year, we have for revenue or traffic account, 102,972*l.*, and as cost of coke for the year 5,780*l.* In Tuck's Railway-Shareholders' Manual, page 114, is given the aggregate amount of revenue on traffic proceeds for the rail ways open in 1845, as 6,124,800*l.* per annum. By dividing this sum by 102,972*l.*, being that of the revenue of the Manchester, Sheffield, and Lincolnshire Railway, we obtain an approximate cost of coke for the whole of the lines there given.

Examples.	Col. 1. Saving effected on £346,800 being the annual cost of coke on the railways open in 1845, as brought out according to the note at the head of the Table.	2. Saving per cent on the cost of coke.	3. Saving per cent. on the whole locomotive expenses.
No. 1 shows the relative cost of coke, as brought out by a comparison of No. 8 in Table A with No. 1 in Table A.	£286,487	82½	29
No. 2 ditto that brought out by a comparison of No. 8, Table A, with that of No. 2 in Table A.	£273,790	79	27½

Supposing the available balance to be such as to afford a dividend of 5 per cent, upon an outlay equal to that of the London and North Western line, such available dividend would be increased by the saving in coke alone 15 per cent, and would enable the directors to give the shareholders an additional 15*s.* on each 5*l.* If to this was added the increased economy which would be attendant on the system set forth in Examples 1 and 2, the saving would exceed 1 per cent., or would increase the value of such railway property, or, what is the same thing, the revenue arising therefrom, *one-fifth*.

THE "TIMES" AND STEAM PRINTING.

"The invention of printing is the greatest event in history. It was the mother of all modern revolutions. It was a complete change in the mode of human expression; it was a human thought throwing off one form and assuming another. It was the complete and definitive renewal of its skin by that symbolical serpent, which, since the time of Adam, has represented intelligence!" Thus writes Victor Hugo.

When the old-fashioned "double-pull" platen press, manufactured of wood, with a metal screw, was partially superseded by the introduction of another, manufactured altogether of iron, from the plans of the late Lord Stanhope, it was thought that the progress of invention (in this direction) must stop; but subsequent experience has shown that in this, as in other branches of the arts, one improvement but prepares the way for another. No sooner were presses made of iron, than the idea occurred of working them by steam; and the first to welcome the new and happy thought was the proprietor of a journal which stood in instant need of some such powerful auxiliary, to enable him to keep pace with a circulation unexampled in the history of the press, and who, without it, would most assuredly never have been able to attain to that prodigious influence which for many years past has at once astonished and awed the world. Kœnig, the ingenious inventor of the steam press, found in the proprietor of the *Times* his natural and best possible patron. With the liberal

Digitized by Google

aid of the late Mr. Walter, he produced a machine of somewhat gigantic size, but nevertheless possessing a completeness of design and purpose which cast all other surface printing presses into the shade. Some there were who, looking only to immediate interests, were in alarm, lest the introduction of steam printing might ruin the trade; and when it was found that men were actually discharged—that their labour was superseded by steam—the inventors of the machine, and those who encouraged them, were actually treated as enemies of the working classes. But, mark the result! A generation of men, amounting to some seven or eight hundred individuals, who were called "pressmen," were partially, and only partially, thrown out of employment; for many of these people were able to "take a turn at case," and earn a decent living in this way; so that, after all, the *immediate* injury was not so great as might have been expected; while, on the other hand, the steam press has given occupation to many thousands who, but for its introduction, would have been standing idle, and who ought, one and all, to bless the memory of Mr. Walter for enabling the inventor to work out his ideas, and perfect his great and glorious undertaking. Consequent upon the great discovery, the old inking-balls were soon cast aside, to give way to the use of composition rollers. Then the first idea of cylinder printing was improved upon: machines, instead of producing seven or eight hundred sheets of printed paper an hour, were soon made to throw off almost as many thousands. The *Times* still kept pace with the genius of invention. Mr. Walter patronized every mechanical improvement connected with the press. Even when his health was declining,—when he found that he must shortly pass to that "bourne whence no traveller returns," he was still as ardently as ever attached to the promotion of useful science, and was busy with a plan for doubling and trebling the number of impressions, which the four cylinder machines were capable of producing. We refer to a machine which is at this moment in the course of erection in a spacious apartment fitted up for the purpose, adjoining the *Times* office, which promises far to surpass every thing of the kind which has yet appeared. The inventor is the well-known Mr. Applegath. It is a wondrous thing to look at in its entirety; but if examined part by part separately will be found to be, in truth, a very simple machine. Imagine a large upright cylinder, of some five or six feet diameter, revolving upon its own axle. On this the type is firmly fixed in iron frames. Each frame holds a page, or six columns of the *Times*, and the bed of this frame, which is an arc corresponding to the circumference of the large cylinder, is planed flat, or rather the parts on which the columns are placed, are planed flat, so that the arc described by the frame or "chase," is scarcely perceptible, or if perceptible, it offers no impediment to the perfect impression of the whole newspaper. This large cylinder may be said to perform a double duty. A portion of it has a vibratory motion, which serves to ensure an equal distribution of the ink; without such a contrivance, the type would soon become clogged, and the appearance of the printing would be anything but satisfactory. Around this huge cylinder there are eight others which revolve on their own axes at stated distances—attendant satellites, as it were, on the great cylinder which is revolving within; and as the form in its revolution passes each of these impression cylinders (as they may be termed), a sheet of printed paper is produced. Then there are minor satellites which revolve close to the impression cylinders, and apply the ink to the type after it has been taken from the duct, and distributed. It must be understood that the cylinders and rollers are all upright. It is calculated that the large cylinder will make thirty revolutions in a minute; and as each revolution will produce eight papers, the machine in one hour will throw off not less than *fourteen thousand four hundred sheets!* But supposing that, at the rate of thirty revolutions a minute, the centrifugal force should have a tendency to throw off the forms of types, a thing by no means unlikely, the rate of speed can be easily reduced so as to produce only ten or eight thousand sheets an hour. Even at these diminished rates of production the advantage gained will be immense; for the present rapid machines will not print more than five thousand sheets an hour, and some not more than four thousand. The manner of feeding the machine is re-

Digitized by Google

markable. To each impression cylinder there is an extensive tape webbing. A lad draws, by means of a "key," the sheet to a certain spot, indicated by a mark; at this moment it is lying horizontally, but by means of friction rollers it is drawn into the webbing and conveyed to such a distance that the sheet stands confined by the tapes in a perfectly upright position: now it comes to a dead stand, and when in the position stated, it is gripped, and then received by other tapes, which convey it round the roller where, after the operation of printing is performed, it is received by a boy.

That this machine may be made to produce printing equal to what we witness now-a-days (we speak of newspaper printing) there cannot be a shadow of doubt; but that "fine work," or anything equal to it, will be the result of the invention, there is not much probability. Altogether, however, Mr. Applegath's machine is as extraordinary as it is novel and simple; and must tend to extend his fame as an inventor and engineer throughout the world.

MR. GEORGE STEPHENSON'S NO-PATENT RAILWAY BREAK.

We extract the following notice from the last number of the *Railway Record:*

"At the late quarterly meeting of the Institute of Mechanical Engineers, held in the theatre of the Philosophical Institute, Birmingham, J. G. M'Connell, Esq., of the London and North Western Railway Company, in the chair, the following communication was received from George Stephenson, Esq., President of the Institute, on a new self-acting break, a beautiful model of which accompanied the paper:

"'The various accidents on railways arising from concussions and collisions (and especially the late accident at Wolverton) have induced me to draw my attention to the construction of a self-acting break, which I have for several years had in view, a plan and model of which I have had made, and now lay before the Society, with my description of its action and effects. When a railway train is moving at the rate of from 40 to 60 miles an hour, the momentum is so great that it cannot be stopped in any reasonable distance by the breaks at present in use; or if an axle-tree break, or any accident happen to the engine, so as to prevent its progressing, the sudden shake causes the carriages to overrun each other, and those next the engine are almost certain to be crushed. In an accident of this kind, neither the engine-driver, stoker, or guard can be prepared; and before there is time for any of them to put on the break at present in use, so as to be in the least degree effective, the collision or concussion has taken place.

"'When the engine-driver shuts off the steam, or applies his break on the tender, the self-acting break is immediately brought to bear upon every wheel attached to every carriage in the train so powerfully, if necessary, as to bring every wheel into the condition of a sledge. I think the train will be brought to a stand by this break in one-tenth of the space in which it can be by the breaks at present used.

"'My plan is as follows:—I attach a couple of spiral springs to the levers of the break of every carriage, and also connect them with the buffers, and if the carriage requires gentle breaking (which will always be the case when a train approaches a station), the engine-driver, by shutting off a portion of the steam, or applying the break gently, will have complete command over the train, without any of those violent uneasy motions, which are very frequent, and excessively disagreeable to passengers; and as the guard is frequently compelled to apply his break so powerfully as to make the wheels slide on the rail, and cause a considerable amount of wear and tear on the tire of the wheel, by which it becomes flat-sided, and makes the carriages uneasy, and creates a jumping motion on the rail.

"'Suppose a train of carriages moving at the rate of from 30 to 40 miles an hour, and a signal is held out for the engine-driver to stop, the moment he shuts off the steam the whole of the breaks are brought into instant application of sledging the wheels, which will be more effectual than 50 men applying the common breaks, as the mischief is frequently done before the guard can be apprized of the approach of danger.

"'It is frequently necessary for the trains to be backed into a siding. When this is required, the train will first have to be stopped, and in one minute the whole of the breaks can be disengaged from the buffers, as is shown in the model, and when the train proceeds, they are again dropped into gear.

"'The plan altogether appears so simple, that any ordinary mind can easily understand the whole of it; and I think the cost of putting the breaks on each carriage would not exceed more than from 5*l.* to 10*l.*

"'Any effectual plan for increasing the safety of railway travelling is, in my mind, of such vital importance, that I prefer lay-

Digitized by Google

ing my scheme open to the world, to taking out a patent for it; and it will be a source of great pleasure to me to know that it has been the means of saving even one human life from destruction, or that it has prevented one serious concussion.

"'GEORGE STEPHENSON.'"

It will surprise no one, who calls to mind how extensively and how incessantly Mr. George Stephenson has been practically occupied in carrying out the railway system ever since its commencement, and how little time, therefore, he can have had to read what others have published on the subject, or even addressed to him directly and personally, to find "the Pope of Railways," as he delights to hear himself called, so ignorant of the various remedies which have been from time to time proposed for the evil which he so humanely seeks to remedy. We could mention off hand (were it necessary) some half-a-dozen plans, at least, which have been proposed for acting simultaneously on the breaks of a railway train; but the idea is so old, and so familiar to most people, as to render special citation superfluous. Not knowing what others know, Mr. George Stephenson acts with indisputable generosity in not "taking out a patent" for his supposed invention; but, as matters really stand, he but gives to the public for nothing what (as far as the would-be donor is concerned) is exactly worth what it costs.

A NEW AND PRACTICAL METHOD ASCERTAINING THE VELOCITY OF PROJECTILES.

Sir,—It has struck me that the velocity of rockets or cannon-balls could be far more correctly and minutely ascertained by the aid of electricity than by the method now in use. The mode of effecting this desirable object I will endeavour to describe in as plain and in as few words as I possibly can. Let a long thin copper wire be conveyed and suspended upon dry sticks from the position of the ordnance cannon to the distant point aimed at. At that point the electric circuit would be formed in the following manner: A small portion of the wire, having one end in connection with the earth, and the other terminating in a small cup of mercury, would be attached to the "*mark*," and a copper ball, having one end of the long conducting wire attached to it, would be placed in such a manner over the cup, that the least vibration caused by the projectile in striking the "*mark*," would make the brass ball to drop into the mercury, thereby forming the circuit. This formation of the circuit by the ball would be instantly indicated at the first or propelling position, by the movement of a small galvanometer introduced into the circuit; and the time elapsing between the act of firing the cannon and the movement of the needle of the galvanometer would represent the velocity at which the projectile traversed the given distance.

OWEN ROWLAND.

11, Heathcote-street, Mecklenburgh-square.

THE POETRY OF STEAM.

Every one knows that the poet laureat has unequivocally *pronounced* against railways. To William Wordsworth, not less than to Colonel Sibthorpe, the very name is fraught with unpleasant images, and redolent of utilitarian and Mammonish associations. "Is there no nook," says the Patriarch of Rydal Mount—

"Is there no nook of English ground secure
From rash assault? Schemes of retirement sown
In youth, and 'mid the busy world kept pure
As when their earliest flowers of hope were blown,
Must perish. How can they this blight endure?
And must he, too, his old delights disown,
Who scorns a false utilitarian lure,
'Mid his paternal fields at random thrown?
Baffle the threat, bright scene, from Orrest head,
Given to the pausing traveller's rapturous glance!
Plead for thy peace, thou beautiful romance
Of nature! And, if human hearts be dead,
Speak, passing winds; ye torrents, with pure, strong,
And constant voice, protest against the wrong."

Now, we do not profess to know how far ancient schemes of retirement may endure the blight of locomotive smoke, while we doubt not that poets and others, who scorn a false utilitarian lure, will find no music in the steam whistle or the fog signal. But we candidly confess our extreme surprise that a philosophic poet should call upon the winds and torrents to protest against the wrong inflicted by the great civilizer of modern times. We feel, indeed, confident that the torrents of Windermere, while with pure, strong, and constant voice, they make music to the listening ear of meditation, may not unprofanely be made to minister also to the requirements of the steam boiler. Thus, if we have less of the *vis divinior*, we conceive we shall find more

Digitized by Google

common sense in the following replication:

Scorn not the railway, Wordsworth! you have frown'd,
Because the railway threatens Windermere;
But did you live in London, 'twould be found
You would be glad to bring the blue lakes near;
To change, within an hour or two, the sound
Of Fleet-street for those wanton wood-notes clear;
The crush and crash of cabriolets and crowds
For meditation of the mingling clouds.
For us, we love the railway as a sign
And token of a world-embracing power,
Which shall in time all men and minds combine,
And creeds and systems. Pray thou that this hour
May come, and quickly, and this faith prevail;
And scorn not, Wordsworth—scorn not thou the rail!

For even as thou hast called upon the critic to "scorn not the sonnet," because with that key Shakspere unlocked his heart, and Petrarch and Spencer, by that medium, gave vent to their sorrows, Dante to his occasional relief from indigestion, and Milton to his indignation; so do thou, great poet of the past, teach thyself respect for an agent by which, as by a key indeed, commerce will unlock her stores; by whose medium the nations will learn to communicate with and to understand one another; ambition, and war, and turbulence be kept in subjection; colonization develope the neglected treasures of the imperial patrimony; and knowledge, civilization, and religion cover the earth as the waters cover the sea.—*Railway Record.*

FENN'S ECCENTRIC LEVER BRACE.

[Registered under the Act for the Protection of Articles of Utility. Mr. Joseph Fenn, tool-manufacturer, of 105, Newgate-street, proprietor.

Fig. 1.

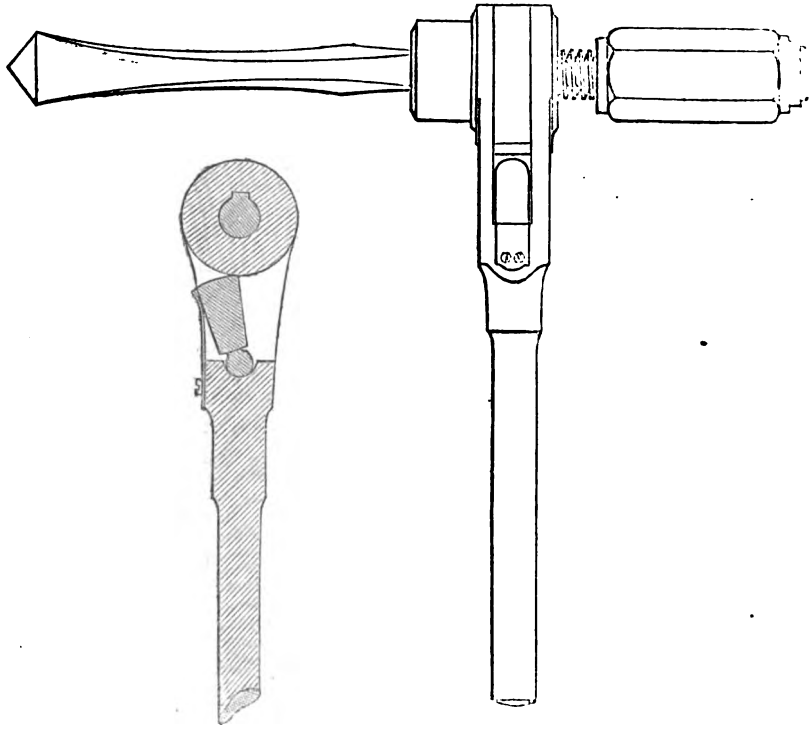


Fig. 2.

Mr. Fenn, to whom tool-making in all its branches is already much indebted, has this week registered a brace which is so cleverly constructed, that it may be worked in almost any situation however contracted. Fig. 1 is a side elevation of

Digitized by Google

this instrument, and Fig. 2 a sectional plan on the line *a b* of Fig. 1. A is the drill-stock, B the screw, which is in one piece with the drill-stock, and C the screw-nut and top centre; D is a steel collar or wheel, which is fixed to the shank of the drill-stock by a slip feather and groove, so that both must turn together; E is an eccentric tumbler, or click, which is kept in its place by the spring F, and abuts at one end in a hollow socket in the butt of the handle G, and at the other against the wheel D, and in such position that it allows the handle to run free in one direction from the drill-stock, but when the handle is turned in an opposite direction, securely locks them, so that both must turn together.

HAWKINS' PATENT CLIP.

[Patent dated March 10, 1847. Specification enrolled September 10, 1847.

No one who is acquainted with the great ingenuity of our worthy friend, Mr. John Isaac Hawkins, and with the mechanical completeness of every thing which comes from his hands, will deem it other than a matter of course that when he applied his mind to the improvement of paper clips, he should devise the very best yet produced.

The object of the invention is stated to be "to produce an instrument to grasp, clip, and hold together, or file, a collection of papers in a condition to be turned over like the leaves of a book, without the instrument presenting any inconvenient protuberance to hinder two or more such clipped collections of papers from lying compactly together in a portfolio; the clipping instrument forming a kind of temporary binding, and occupying only a small space along the back margin of the mass of papers."

The inventor effects this purpose by the clip represented in the accompaning engravings; fig. 1 being a flat view, as seen when lying on a table; fig. 2, edge view, as seen when looking against the front edge of that margin; fig. 3, end view; and fig. 4, of the bars, or long jaws, *c*.

a a represent two pair of springs, of steel, or other elastic metal.

b b, projections extending sideways from the extremities of the springs, to act as compressing jaws for grasping or clipping the papers in two places, more or less distant from the top and bottom of the papers.

c c a pair of bars, or long jaws, attached

Fig. 2. Fig. 4. Fig. 1.

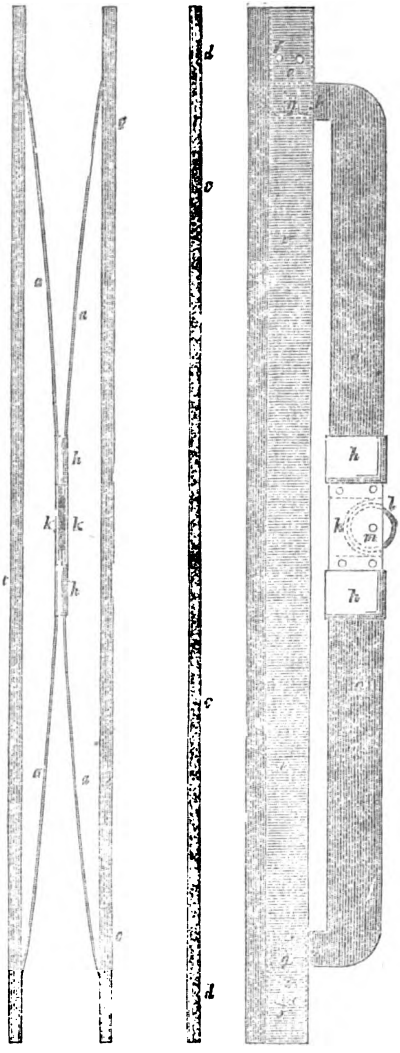
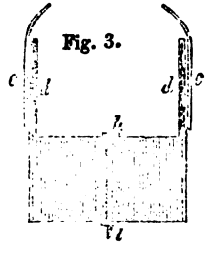


Fig. 3.



Digitized by Google

to the projections or short jaws *b*, for the purpose of grasping the back margin of the papers throughout its whole, or a greater part, of its length.

d, four forked plates rivetted to the long jaws *c*, to form recesses for the short jaws *b*, to act in and press the long jaws against the papers.

e, flat view of these forked plates, shown by the dotted lines at two places in fig. 1, and shown separately in fig. 2, which is an edge view.

f, the rivets.

g, studs fixed in the short jaws, to slide in the forked plates, and to keep the long jaws from slipping off from the short jaws.

h, ferrules, or flat rings of brass, or other suitable material, sliding on the springs *a*, to compress them together, and force the jaws to grasp the papers.

k, two plates of metal, riveted on the outsides of the middle parts of the springs *a*; the rivets passing through the springs and through a horse-shoe-like plate placed between the springs, the hollow part of the horse-shoe forming a recess for a ring to slide in. The shape of the recess is shown by dotted lines in fig. 1.

l, the ring sliding in the recess, so as to be pushed in, and present no inconvenient protuberance when the clip is used in a portfolio, and pulled out when it is required to hang the clip up.

m, a pin, put through the plates *k* and the middles of the springs, near the mouth of the recess, to prevent the ring from being drawn quite out of the recess.

RAILWAY BUFFERS.

Dear Sir,—It appears to me that your correspondents on the subject of railway carriage buffers, have not sufficiently considered the nature of the evil which they seek to overcome. The remedy which they propose would only substitute for that evil another of an equally, if not of a more dangerous, character, as I will presently endeavour to show. The inequality of height of the different carriages in a train arises from two principal causes: the first is, the mixing up of new, or comparatively new carriages, with old ones, the springs of which have become permanently depressed by long-continued use; the second is the unequal loading of the different carriages. Now if the oldest and lowest carriages chance also to be the heaviest laden, which is very likely, the inequality is greatly increased; not only because of the greater deflecting power of the heavier load, but because the springs, having lost a portion of their original *charge*, are therefore less able to support the weight than those of the newer carriages. All the buffers then become as inclined planes, relatively to each other, ready to throw the lighter carriages off the rails on the first favourable opportunity—of course, I allude to the present system of convex buffers. Now let us see how the Procrustean system of locked buffers, as proposed by some of your correspondents, would act. In the first place the railway men who make up the trains, would have to force the convex buffers of one carriage into the corresponding cup buffers of the next; either by depressing the highest carriage of the two, or by lifting the lowest one perhaps 3 or 4 inches. Would this be an easy task? Suppose it however to be accomplished; the consequence would be this, that one kind of inequality would be exchanged for another. Before the buffers were forced to "match," the train would be in a line something like that represented in fig. 1. Afterwards it would assume the appearance shown in fig. 2—all the springs endeavouring to recover their horizontal position by bending the buffer rods. If the carriages are then unequally loaded in the manner I have before described, this tendency to bend the rods is much increased, and their action on the buffer springs greatly impeded. This, however, is not the worst of it. Suppose two lightly loaded carriages coupled together, but attached to heavily laden ones at their opposite ends; the outer buffer rods of the light carriages then become levers, by means of which the heavy carriages are endeavouring to lift the inner ends of the light ones—the axles nearest to them serving as fulcra. The sketch, fig. 3, will show my meaning more clearly:

A A are the heavy carriages, B B the light ones.

It may be said that the forces thus exerted could not be great; but those who may have seen a railway collision, as I have done, knowing the tendency of the carriages at such a time to "*rear up*," will be careful to avoid assisting such a tendency, even in the slightest degree.

The remedy for these evils, appears

Digitized by Google

Fig. 1.

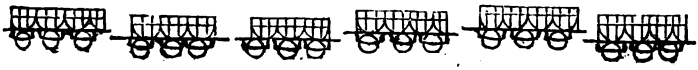


Fig. 2.

Fig. 3.

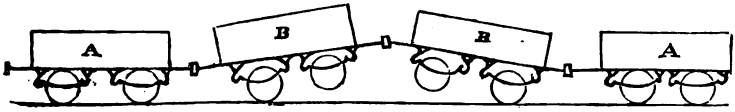


Fig. 4.

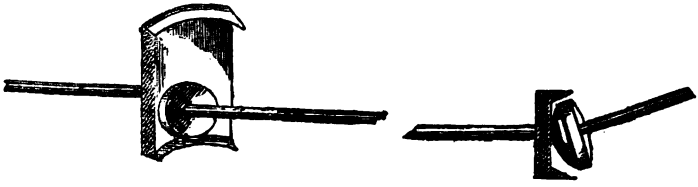


Fig. 5.

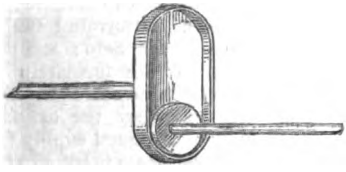


Fig. 6.

to me, a very simple one. Let one pair of buffer-heads on each carriage be of an oblong form, rather wider than the common circular buffer-head, and twice as high. Let the face of this oblong buffer-head be made hollow, or concave, *vertically*, and the corresponding circular convex buffer of the next carriage will then be sure of a proper contact, however unequal the carriages may be in height. Each carriage will then have its springs free to act according to its own load, and will always preserve its proper horizontal position. A guard, plate at the bottom and top of the oblong buffer-head would be useful in case of such accidents as Sir George Cayley describes.

Digitized by Google

This form of buffer had occurred to me some time before the subject was broached in your pages.

I am, Sir, yours, &c.,
JAMES ROCK, Jun.

Hastings, September 6, 1847.

P. S.—The ends of the oblong vertical buffer may be circular if preferred, as shown in fig. 4; and the guard plate may be carried all round, instead of the bottom and top only: in which case the face may be flat instead of being hollowed out, which may be an advantage in going round a curve, by keeping the thrust of the convex buffer nearer to the centre of the other, as will be seen by the horizontal sections, figs. 5 and 6, the former of which shows the nature of the contact with a flat-faced oblong buffer, and the latter that with a concave one.

REMARKS ON CALCULATING THE POWER AND EXPANSION OF STEAM; WITH A PRACTICAL APPLICATION OF THE SAME TO DETERMINE THE ACTUAL WORKING POWER OF THE ENGINES ON BOARD THE "WASHINGTON" STEAM-PACKET, &c.

Sir,—I have very often been much pleased with the mathematical papers which have appeared at various times in your scientific Magazine, but more particularly those that were applicable to mechanical subjects. I believe that they cannot fail of being very acceptable and of vast utility both to amateur mechanics and practical engineers. I was particularly delighted with the article by "A. H.," in No. 1248 of your Magazine, and pages 31, 32, 33, and 34, upon the subject of cutting off the steam, and then letting it expand, so as to fill the cylinder and finish the stroke of the piston. As I have been out of practice of the differential calculus for some years past, I paused a moment when I read the formula,

$$\text{"P. } a \text{ (log } b - \log a\text{)," &c.,}$$
$$\varepsilon \qquad \varepsilon$$

and asked myself what sort of logarithms are here intended to be used? For I saw at once that the common, or Brigg's logarithms, would not do. I then immediately remembered that the Napierian, or hyperbolic logarithms, were the kind used in finding fluents and the sums of infinite series, &c.

I then, in a few minutes, completed the series in the calculation for cutting off the steam at one-tenth of the stroke of the piston. I believe that, in these calculations, we ought to consider the steam in its unexpanded state, just at the instant it is cut off, as being the first term of the series; and the first expansion, or when it fills just double its original volume in the cylinder, as being the second term of the series; and the second expansion, when it fills three times its original bulk, as being the third term in the series; and the ninth expansion, when the steam occupies ten times its original space in the cylinder, as being the tenth term of the series, &c. If I am correct in this view of the subject, I believe that I must be right in the rest of the process. I was much pleased to find my calculation agree so exactly with the result given in No. 1248, page 32, where the writer gives the pressure before expansion as P=1000 lbs., I find, accordingly, that the work done by expansion, through the first foot, will be =693·1 lbs.; the second expansion, or three feet of the cylinder, =405·5 lbs.; the fourth foot, =287·7; the fifth foot, =223·1; the sixth foot, =182·3; and the seventh foot, =154·2; the eighth foot, =133·5; the ninth foot, =117·8; and the tenth foot, =105.4 lbs.; the sum of the series being 2302·6; being precisely the result given by "A. H."

I have made use successfully of his formula, in a very simplified form, to determine the actual working power of the engines of the *Washington* ocean steam-packet, which are rated as being of 1,000 horse power, but which are shown, by these calculations, to fall greatly short of performing the amount of duty claimed for them; and the same modification of the formation will be found equally applicable to all other steam engines where the cylinders are not filled by a continued supply from the boilers, and the steam is cut off at a given part of the stroke of the piston.

I believe these calculations may be useful to many of your practical readers, and therefore, Mr. Editor, should you deem my humble contribution worthy of a place in your very valuable publication, I shall feel much obliged to you for its insertion.

The *Washington* ocean steamer has two cylinders, the piston of each of which makes a stroke of 10 feet; diameter of

Digitized by Google

each cylinder, 72 inches; area of each, 4071 square inches; and each equal to 500 horse power. Taking the one horse power at 228 lbs., as given by Watt, 500 horse power would be equal to a pressure of 114,000 lbs. on each piston, at 28 lbs. the square inch, before the steam is cut off to be expanded. Here we have P = 114,000 lbs.; and the hyperbolic logarithm of 2 = 0.693147, of 3 = 1.098612, of 4 = 1.386294, of 5 = 1.609438, of 6 = 1.791759, of 7 = 1.945910, of 8 = 2.079441, of 9 = 2.197225, and 10 = 2.302585. Now, by multiplying P = 114,000 lbs. into each of the foregoing hyperbolic logarithms, we shall obtain the following results, which I have given in a tabulated form, which are enclosed in the subjoined sketch of a cylinder, where A represents the bottom of the cylinder, and D the top thereof, B the piston, and BD the piston-rod. In this sketch it is not intended to show the proper thickness of the piston, but it is represented merely by a straight line, in order to give a clearer idea of the different expansions. The cylinder is represented 10 feet long, and 6 in diameter, as a matter of course. In the *Washington* steamer, the internal length of each cylinder is 10 feet + the thickness of the piston, &c.

1	2		3	4	5	
					D	10
Areas.	Diam.			H. P.		
428·9	23·4	*k*	12,011 =	52	262,495	
479·5	24·7	*i*	13,428 =	59	250,484	9
543·6	26·3	*h*	15,222 =	67	237,056	8
627·9	28·26	*g*	17,573 =	77	221,834	7
742·3	30·75	*f*	20,785 =	91	204,261	6
908 5	34·	*e*	25,439 =	112	183,476	5
1171·9	38·6	*d*	32,815 =	144	158,037	4
1650·	45·8	*c*	46,203 =	203	125,222	3
2822·	60	*b*	79,019 =	346	B 79,019	2
4071·	72	*a*	114,000 lbs.			1
					A	

The column No. 5, shows the amount of work done by the expansion of the steam for each foot of the cylinder; and thus it is shown that when expanded 1 foot, that is when cut off at 1 foot and expanded so as to fill 2 feet of the cylinder, the work done by the second foot of the piston will be 79,019 lbs.; and that at nine such expansions, the amount of the whole will be 262,495 lbs., of one foot of steam expanded so as to fill ten feet or the whole cylinder. Again, *b*, *c*, *d*, &c., column 3, shows the work done by each foot separately; and column 4 shows the equivalent horse power of the same. The columns 1 and 2 show the areas and diameters that would give the same power, if worked with steam of the original pressure. Hence we see that if the steam were cut off at 1 foot, the piston, of 72 ins. diameter, during the tenth, and last foot of the stroke, would do no more work than could be done by a piston of only 23·4 ins. diameter, and working at the original pressure of 28 lbs. to the square inch. We may here briefly observe that the sum of the series of nine expansions = 262,495 lbs., added to 114,000 lbs., the first term gives the total 376,495 lbs. as the work done by the entire stroke of the piston through the ten feet of the cylinder. One tenth of the sum, or 37,649 lbs. = 165 $\frac{1}{10}$ horse power, only will be the average of work done if the steam be cut off at one foot of the stroke of the piston, instead of doing the work of 500 horse power.

To render still more clear this simplified mode of applying the integral,

Digitized by Google

or differential calculus, to determine the work done by the expansion of steam in the cylinder: I will show the method I use when the steam is not cut off at an even, or aliquot portion of the stroke of the piston. Thus, supposing the whole stroke to be 10 feet, as in the former example: but instead of cutting off at 1 foot, as in the former case, we will now cut off the steam at exactly 3 feet of the stroke of the piston; and here taking the pressure as before at 28 lbs. the square inch, at which pressure, on a piston of 72 inches diameter, the force exerted will be 114,000 lbs. until the instant of cutting off, and as in this case there are 3 feet in length of the cylinder filled with steam unexpanded as it came from the boiler, to be expanded so as to fill 7 more feet of the cylinder, I consider the work done by the piston in passing through this (first) 3 feet of the cylinder, as being the integral from which we have to find the sums and the differences of the work done by expansion in the remaining part of the cylinder: and, therefore, we take 114,000 lbs. × 3 = 342,000 lbs. = P. (or A.) And according to the explanations before given, we take the first 3 feet of the stroke of the piston to be the first term; and the first 3 feet done by expansion, or when the steam fills exactly 6 feet of the cylinder as the second term, = B; and the second 3 feet expanded, or when the steam fills 9 feet (in length) of the cylinder, as being the third term of the series, = C; and the exponents, or co-efficients will be 1·2·3, all integral numbers. But the expansion due to each odd foot, taken intermediately, will be expressed by a fractional exponent; then the complete series will stand thus:

1. $1\frac{1}{2}$. $1\frac{2}{3}$. 2. $2\frac{1}{2}$. $2\frac{2}{3}$. 3. and $3\frac{1}{2}$.

The hyperbolic logarithms of each of those numbers multiplied into P = 342,000 lbs. will give the sum of the expansions up to that term of the series inclusive. Thus, B = hyp. log. of 2 × P = 342,000 lbs. gives 237,056 lbs. due to the first 3 feet of expansion, and the hyp. log. of 3 × P = 342·000 lbs. gives 375,725 lbs. the sum of both B and C, or the work done by expanding the steam till it fills 9 feet of the cylinder. Then for D the 7th foot, or complete filling of the cylinder, we take the hyp. log. of $3\frac{1}{2} = \frac{7}{3}$ = 1·203973 × 342,000 lbs. = 411,758 + lbs., being the sum of all the series, or the work done by expansion by the piston finishing the last 7 feet of its stroke. Now to find the work done by the first foot expanded, we take the hyp. log. of $1\frac{1}{3}$, or of $\frac{4}{3}$ = 0·287685 × 342,000 = 98388 lbs. the answer; and the series completed will stand thus: $1\frac{1}{3}$ = 98388. $1\frac{2}{3}$ = 174702. and 2 = 237056 lbs. and $2\frac{1}{2}$ = 289776. and $2\frac{2}{3}$ = 335443. and 3 = 375725. and $3\frac{1}{2}$ = 411758 lbs., these being the sums which include the amount of all the preceding terms. And their differences will be for $1\frac{1}{3}$ = 98388. for $1\frac{2}{3}$ = 76314. for 2 = 62354. for $2\frac{1}{2}$ = 52720. for $2\frac{2}{3}$ = 45667. for 3 = 40282. for $3\frac{1}{2}$ = 36033 lbs., which differences show the work done by the 1st, 2nd, 3rd, 4th, 5th, 6th, and 7th feet of expansion separately. Then for the average of the work done by the complete stroke of the piston, to the sum of the series 411758 add 342000 the work done before cutting off the steam; the sum is 753758 lbs., one-tenth of which 75375 + lbs. the average for each foot of the stroke of the piston, equal to 330 horse power instead of 500 horse power.

And in this manner I have found the amount of work that would be done by each cylinder on board of the *Great Washington Ocean* steam packet. If the steam were cut off at $\frac{1}{2}$ the stroke = 423·2 h. p., at $\frac{1}{3}$ = 349·7 h. p., at $\frac{1}{10}$ = 330· h. p., at $\frac{1}{4}$ = 298·2 h. p., at $\frac{1}{5}$ = 260·9 h. p., at $\frac{1}{10}$ of the stroke = $165\frac{1}{10}$ h. p., instead of 500 h. p. in each case. These last numbers may be useful to persons who have not time or inclination to go through the calculations in the manner explained in this article, and may desire to know the work done by any other engine, simply by the sliding Gunter. Thus, suppose it were required to find the actual amount of work done by an engine of 120 horse power when the steam was cut off at $\frac{8}{10}$ of the stroke of the piston, the proportion would stand thus:—As 500 : 330 : : 120 : $79\frac{1}{2}$ h. p.; set 500 on B (the slide) opposite to 330 on A the first line of numbers; and then opposite to 120 on B you will find $79\frac{1}{2}$ on A, the answer; so that, an engine commonly rated as a 120 h. p., will, if the steam be cut off at one-third the stroke, in reality do no more than $79\frac{1}{2}$ h. p. for the work done.

This letter will show the public how much they are deceived when they read accounts of "splendid engines of immense power," which, as I have here

Digitized by Google

demonstrated, are in reality doing no more than one-half or two-thirds of the work they are stated to perform. Indeed, they scarcely do so much as this, which is in consequence of using the CRANK, that *beau ideal* of mechanical excellence in the minds of wealthy manufacturers, or eminent engineers, whose delight is to substitute elegant specimens of workmanship, instead of really useful inventions and economical improvements, which they believe would lessen their profits, and require more skill and diligence in the construction.

Having already given a very ample demonstration of the disadvantageous operation of the crank in my essay thereon in No. 770, and page 92, of the *Mechanics' Magazine*, I believe it would not be difficult for me, in another communication, to show that, by the combined effects of cutting off the steam and the loss of power by using the crank, engines on board steam-vessels do not perform in reality more than one-third the duty they are rated at. In fact, the very little power exerted by the crank, until it has performed about one-fourth of the stroke, compels the engineers to employ cylinders and pistons of enormous dimensions, in order to obtain a GRAND PUSH to set the other machinery in motion. This is, indeed, the real secret why such expensive engines of monstrous dimensions continue to be manufactured.

In conclusion, I beg leave to say, that I do not send this present contribution to your very valuable and interesting magazine as a specimen of mathematical skill. I do not in the least put myself in competition with any of the very talented gentlemen who contribute to your pages; on the contrary, if I am wrong in the calculations here submitted, I shall feel thankful to be set right by any one on a subject so very important as the one under consideration. My merit herein is of a humble kind: I pretend to no more than the simplifying of abstruse formula, and putting the calculations into such an easy form, as to be easily understood by, and serviceable to, the operative engineer and mechanic. I am, Sir,

as I have been for more than
twenty-four years past,
your constant reader,
THOMAS OXLEY, C. E.

London, July 17, 1847.

CUNNINGHAM AND CARTER'S ATMOSPHERIC RAILWAY.

In our journal of the 1st of May last (No. 1238), we gave a full description of this new system of atmospheric propulsion, and pointed out some of the more remarkable peculiarities in respect of which it differs from every other system yet proposed. We have this week had the pleasure of inspecting a working model of a railway on this plan, which the patentees have constructed at Peak Hill, near Sydenham, and would recommend every one who may not have fully comprehended the mode of action devised by Messrs. Cunningham and Carter, or who may have any doubts about its efficiency, to go also and see the thing at work. The model is not on a large scale, yet still large enough to prove that the principle of the invention is sound, and one which will hold good with almost any increase of dimensions.

The model exhibits to us first a circular railway, of some fifty feet or thereabouts round, with two lines of rails, and two trains of carriages upon them. Then there is an air tube, or atmospheric main, with no valve in it, but perfectly close, which runs along the outside of this railway, and is worked (that is, which is more or less exhausted according to the working pressure required) by means of a stationary steam engine placed at one side of the railway. Next there are branch pipes, which lead off from the atmospheric train to small horizontal air engines, fixed in pairs by the sides of the railway, at three points of the circle. It is supposed that, in actual practice on a large scale, one stationary steam engine for every ten miles would suffice, but that a pair of the small air engines would be required for every 500 feet. The immediate office of these air engines is to propel the carriages along the railway, which they do in this way:—Between every pair of air engines there are three stationary horizontal wheels, one occupying the space between the two lines of rails, and the others the spaces between the rails of these lines respectively; and all the three are connected by bands; so that when motion is communicated to one of the three, it is communicated to the whole. Each carriage, again, has

Digitized by Google

attached to it, on both sides, what are called "traction" rails (*friction* rails would perhaps be a more appropriate term), which are so constructed as to fit against the peripheries of the horizontal wheels. Now, supposing a carriage to be advancing towards one pair of these air engines, it first catches against a tappet, which opens the communication between these engines and the atmospheric main, and sets both engines a going, which, in their turn, instantly put in motion the three horizontal wheels; and, as the carriage passes onwards, its traction rails come into contact with the peripheries of two of the revolving wheels, and from this frictional contact is derived a degree of propulsive power sufficient to carry the carriage forward to the next stage or pair of air engines. Then, as soon as the carriage has passed the engines, it strikes another tappet, which shuts off the communication with the atmospheric main, and instantly brings the wheels and air engines to a stand, so that they are in motion only as long as they are serving to propel the carriage, and no longer. And so the work goes on unceasingly, at a rate of velocity varying with the extent to which the atmospheric main is exhausted. For many minor details touching the slides, connecting-rods, &c., we must refer to our previous description.

During the model experiments which we witnessed, the pressure indicated by the barometer varied from 9 to 15 inches, and the speed was of all rates, from very slow to very fast—say, at least, 40 or 50 miles an hour. The speed, too, instead of consisting, as might naturally enough be anticipated, of a series of short starts or runs, each of rapidly diminishing velocity, was, to all appearance, and for all practical purposes therefore, perfectly uniform. The instantaneousness with which the trains were brought to a dead stand, when running at even the greatest velocity, was very remarkable. It resembled exactly what one might suppose would be the case were a carriage on a common road separated from the horses drawing it by a sudden severing of the traces; all the drawing power being gone, it would of itself have the power only *to stop*. Another important fact exemplified by the experiments was, the all-sufficiency of the system, even though parts of the machinery should fail to act. One of each pair of air engines was repeatedly thrown out of gear, yet the carriages went on as before, though but actuated by half the usual propelling power. We presume that the distances between the pairs of engines are so calculated by the patentees as to allow of the possible, yet extremely improbable, contingency, of one of each pair always going wrong; but it would be better still were the distances so arranged that, though *both* the engines of a pair were to fail, the transit would still continue. We hold it to be the next thing to a positive impossibility that any two following pairs should wholly fail one after the other.

The number of air engines required for such a system will, at first sight, strike the reader as involving a most objectionable amount of first cost and working expense; but, in point of fact, there is nothing of the sort. The engines are very simple affairs, each consisting of very little more than a cylinder and piston; they require no separate attendance, and the fuel to work them is but the atmospheric pressure which everlastingly surrounds them, and costs nothing but the wear and tear of the machinery employed to turn it to account. The entire cost of air engines, for any given line of railway, would certainly not amount to more than one-fourth of the locomotives required to do the same work; and, if we were to add another fourth for the probable cost of the stationary steam engines, atmospheric main, and appendages, this system would still have an advantage of one-half over the ordinary steam locomotive plan.

The patentees calculate that a *double* line of railway on their plan might be constructed for 4000*l.* a mile, exclusive of the cost of roadway and rails. From the proceedings of the South Devon Railway, reported in our last Number, it appears that a single line, on the plan of Messrs. Clegg and Samuda costs 10,000*l.* a mile; and double, therefore, 20,000*l.* The objection justly taken by Mr. Robert Stephenson to the atmospheric system, on the ground of economy of construction, is thus for the first time satisfactorily removed. The patentees calculate further that such a line might be worked at a cost not exceeding the wonfully small sum of *three-pence halfpenny*

Digitized by Google

per ton per mile. We subjoin the particulars of this calculation.*

Here, then, we have a plan of propulsion which affords all the advantages ever anticipated from the atmospheric system, without any of those drawbacks which have hitherto clouded its fortunes, and which is not only much cheaper than the ordinary steam locomotive system, but entirely free from all those dangers and consequences which are its inseparable attendants.

Propulsion, by an agency which is the free gift of nature—ever at hand, ever ready for use, and ever to be had in exhaustless abundance.

No steam engines; consequently, no fire—no smoke—no fiery ashes—no damage to person or goods—no stifling smell of burnt grease or tallow—*no explosions.*

Propulsion, on a plan, which though it does not exclude a remote possibility of the carriages slipping off the rails, provides for their being instantly brought to a stand by their own gravity.

No dragging of carriages and passengers to destruction by a mechanical mad horse, liberated from all control by the mere shifting, perchance, of a switch (no more in its way than the waving of the branch of a tree to the horse natural), and converted from a useful servant to one of the worst possible of masters.

Speed of transit, equal to whatever steam can accomplish, with a pleasure unalloyed by the slightest apprehension of danger, and with a degree of comfort in which every sense concerned in locomotion is alike considered,—feeling, seeing, smelling, and hearing.

We have a strong faith in the system which offers such advantages as these, and cannot bring ourselves to suppose that they can long remain either overlooked or unappreciated. On main lines of traffic we do not hope to see it adopted till it has been tried on some short line or lines, and proved beyond all doubt to possess the superiority claimed for it; but were it even to be for ever confined to short lines, it will confer incalculable benefit on any country in which it is introduced. Exceedingly cheap, and as simple as cheap, requiring very few hands to work it, and but little skill in the few—it may be adopted in a great many localities, the traffic of which would not allow of the introduction of any dearer or more complicated system.

ADCOCK'S PATENT SPRAY-PUMP.

Sir,—When your correspondent "Cadsell Marlais" thinks proper to write in his own name, date from his own place of abode, and give data, and not figures which he *pretends* to be data, I probably may deem it worth my while to reply to him. He implies, that he was at Llanhiddel Pit, during one of the public exhibitions of the spray-pump. If he *was* there, he has wilfully and wickedly perverted facts; and the gentlemen who did me the honour to attend the public exhibitions will well know how to appreciate statements such as his. Engaged as I am, Mr. Editor, in matters so important as these, it cannot be supposed that I can find time to reply to every anonymous correspondent, who, assassin-like, stabs in the dark. I have no doubt, however, that an article so utterly at variance with facts, will, like an over-dose of poison, carry with it its own antidote. The letter is malicious towards me, and an insult to the understandings of those scientific *and practical* men, who have seen the operations of the spray-pump, and have given orders.

I rely, Mr. Editor, on your impartiality for the insertion of this, and am, Sir,

Your obedient servant,

HENRY ADCOCK.

London, Sept. 15th, 1847.

---

* Daily expense of working a Double Line 50 Miles long during a period of 10 Hours, with trains starting from each terminus every half hour. *Six trains always running.*

				£	s.	d.
Coals for 5 Stationary Engines, 100 horse power each, at 5 lbs. per horse power per hour, say 11 tons at 14s.				7	14	0
Wages.						
Engine men, with relief, ...	10 at 6s.		3	0	0	
Stokers	10	4s.	2	0	0	
Cleaners	10	2s. 6d.	1	5	0	
Drivers	12	5s.	3	0	0	
Guards	12	5s.	3	0	0	
Men stationed along the line, with relief,	20	3s.	3	0	0	15	5	0
Repairs of engines with depreciation, &c., &c, at £200 per annum each, £1000; daily proportion				2	15	0
Add for contingencies				4	6	0
				£30	0	0

40 Trains at 15s. per train, £30 0s. 0d., or 3¾d. per train per mile.

Digitized by Google

LIST OF ENGLISH PATENTS GRANTED FROM SEPT. 9, TO SEPT. 16, 1847.

William Hancock, Pentonville, gentleman, for certain improvements in bolts, locks, and other fastenings. September 16: six months.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 262.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

George Holland, of Holborn-bars, frame-work knitter: of "a new method of manufacturing and improving hosiery and various other articles for clothing and coverings," made of woollen, flax, hemp, hair, cotton, silks or fur, or mixtures of any two or more of them, by coating, covering, and uniting, with them beavers' furs, coneys' wool, hares' wool, sheep's wool, mohair, or the wool, fur, hair, or down of any animal, or any two or more of them mixed together; or any one or more of the above articles mixed with silk, cotton, or any vegetable production used for the manufacture of clothing. Cl. R., 32 Geo. 3, p. 7, No. 12. July 24, 32 Geo. 3; August 23, 1792, 32 Geo. 3.

James Tucker, of Old Store-street, smith: of an improved register stove, whereby the fire can be removed back a little or much at pleasure, or wholly extinguished, and that without making any dust or disturbance in the room, and which is also a great security against accidents happening by fire. Cl. R., 32 Geo. 3, p. 7, No. 11. July 24, last; August 22, 32 Geo. 3, 1792.

James Smart, of Emsworth (Southampton), blacksmith: of an invention of making a plough-share and share bed. Cl. R., 32 Geo. 3, p. 10, No. 4. April 26, 1792; May 16, 1792.

Abraham Hill, of Whiteley Wood, sawmaker: of "an invention of making scythes with steel blades and iron or steel backs fixed on with screws or pins." Cl. R., 32 Geo. 3, p. 15, No. 15. December 17, 32 Geo. 3; 27 Dec. 1791.

Samuel Lucas, of Sheffield, refiner: of a method of bringing iron ore, and also calx of iron, into a metallic state without first rendering either of them fluid. Cl. R., 32 Geo. 3, p. 17, No. 7. April 18, 32 Geo. 3; May 12, 1792.

Samuel Burman, of Brackley (Northampton), cordwainer: of "a newly invented half boot," having an opening at one side, and a water guard fixed to the vamp and lap quarters, the cut or opening admits the foot easily into the boot, the manner of placing and fixing the water guard effectually keeps out the water and wet, which drains through the laced, and other boots with openings. Cl. R., 32 Geo. 3, p. 19, No. 12. April 18, last past; May 16, 32 Geo. 3, 1792.

Robert Barber, of Bilborough (Notts.), gent.: of a machine for making lace work, fishing nets, garden nets, horse nets, rabbit nets, game nets, or any other kind of nets. Cl. R., 32 Geo. 3, p. 29, No. 14. May 15, now last, 32 Geo. 3; June 13, 1792.

John Donaldson, of Tavistock-row, Covent-garden, gent.: of "a new invented method of preserving animal and vegetable substance." Cl. R., 33 Geo. 3, p. 1, No. 8. Februar y19, 33 Geo. 3; March 14, 1793.

James Axon, of Carey-street, turner and carpenter: of an invention of "a machine for cleaning and fining raw cotton, silk, and wool." Cl. R., 33 Geo. 3. p. 2, No. 19. Feb. 27, 33 Geo. 3; March 27, 1793.

Thomas Binns, of St. Marylebone, carpenter: of "a new invented machine or apparatus for water closets and privies, which upon a self-acting principle, when such water closets or privies, wherein such machine or apparatus shall be fixed, are made use of, will introduce water into the bason in such water closet or privy, and empty and cleanse the same, and close up the same again, leaving a proper portion of clean water in the bason, and thereby preserving the bason clean and preventing any offensive smell without the manual assistance or the attention of any person thereto." Cl. R., 33 Geo. 3, p. 2, No. 13. March 15, last; April —, 33 Geo. 3, 1793.

Matthew Pitts, of Abinger (Surrey), Captain in His Majesty's Corps of Royal Engineers: of "new invented improvements on the steam-engine, and a new invented method of generating steam, with its application to steam-engines, or for any other purpose where steam is used." The improvement on the steam-engine relates to the piston in the great or house cylinder, the padding or stuffing whereof, which surrounds the circumference of the piston, is so contrived that as it wears away it is extended and made to fit the cylinder without any fresh padding or stuffing, or being taken out, as has hitherto been the practice. Cl. R., 33 Geo. 3, p. 2, No. 10. March 25, 33 Geo. 3; April 23, 33 Geo. 3, 1793.

(*To be continued.*)

Digitized by Google

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Sep. 9	1191	Henry Jones	Rose-street, Covent-garden	Air regulator.
,,	1192	Bartholomew Brittain	Waterloo Bridge-road	Bracket for French bedsteads.
,,	1193	William Samuel Burton	Oxford-street	Collapsible sponging bath.
,,	1194	William Samuel Burton	Oxford-street	Collapsible shower bath.
10	1195	Swain and Co.	Oxford-street	Syrian paletot.
11	1196	James Dixon and Sons	Sheffield	Dish-cover.
14	1197	Henry Thompson	Long Acre	Portable folding rocking-chair.

Advertisements.

Viaducts and other Railway Work.

THE attention of Railway Engineers, Architects, and Contractors is particularly directed to the great advantages to be derived from the application of SEYSSEL ASPHALTE, as the *only impervious and permanent* covering for arches and roofs, and lining of reservoirs, gutters, &c. The arrangements of CLARIDGE'S PATENT ASPHALTE COMPANY enable it to execute works of any extent with the greatest promptitude.

In order to guard against the use of spurious materials, it is important that all applications for works to be executed be made direct to this Company; and, as a further protection, it is suggested that Engineers, Architects, and Contractors should require a CERTIFICATE from the Company that the proper description of material has been used.

Information may be obtained as to all works which have been executed by the Company since its establishment in 1838, which will prove that the failure of many works represented to have been done with the genuine material has resulted from the substitution of a spurious one.

I. FARRELL, Secretary,
Seyssel Asphalte Company, Stangate, London.

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings, and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Patent Bells.

MESSRS. MEARS beg to call the attention of the Trade and the Public generally to these articles, which they are now prepared to supply in any quantity and variety. The composition is of a new metal, called the Union Metal, and the bells are of very beautiful tone, and cheaper than those made of the ordinary bell metal. Orders received at the Bell Foundry, Whitechapel, for house, cattle, and other bells.

Just published, second thousand, Vol. II.

Turning and Mechanical Manipulation.

By CHARLES HOLTZAPFFEL, A. Inst. C. E. &c.

THIS work is intended for general reference and practical instruction on the Lathe, and the various mechanical pursuits followed by Amateurs. To be comprised in six volumes.

Vol. I.—(Second Thousand)—On Materials, their differences, choice, and preparation, various modes of working them generally without cutting tools.
Octavo, cloth, pp. 462, and 315 woodcuts.
Price 15s.

Vol. II.—(Second Thousand)—On the Principles of Construction, Action, and application of Cutting Tools, used by hand: namely, chisels and planes, turning tools, boring tools, screw-cutting-tools, saws, files, shears, and punches; and also of machines derived from these hand tools.
Octavo, in cloth, pp. 562, and 711 woodcuts.
Price 20s. In the press.

Vol. III.—On Abrasive and Miscellaneous Processes, which cannot be accomplished with Cutting Tools.

Vol. IV.—On the Principles and Practice of Hand or Simple Turning.

Published by Holtzapffel and Co., engine, lathe, and tool manufacturers, 64, Charing-cross, and 127, Longacre, London; and to be had of all Booksellers.

The Prospectus, with Table of Contents, free by post.

Enfeebled Hands.

HOLTZAPFFEL and Co.'s PEN-HOLDER for ENFEEBLED HANDS.—Registered September 16, 1846.—This instrument was invented by the late Mr. CHARLES HOLTZAPFFEL, for the use of those persons who, from age, rheumatism, gout, stiffness in the joints of the fingers, paralysis, or infirmity, are deprived of the free use of the fingers, so that they cannot hold a pen in the customary position. The Pen-holder is adapted to receive a gold, steel, or quill pen, at the option of the individual, and the instrument may be carried in the pocket, as it folds into the size of an ordinary pencil-case. Instructions for using the pen for enfeebled hands, with a diagram, sent free by post, on application to HOLTZAPFFEL and Co., engine, lathe, and tool manufacturers, 64, Charing-cross; and 127, Longacre, London.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

Spence on the Specification of a Patent.

This day is published, in 8vo., price 7s. 6d., boards,

A TREATISE on the Principles relating to the Specification of a Patent for Invention; showing the standard by which the sufficiency of that instrument is to be tried.

By William Spence, Assoc. Inst. C. E., Patent Agent.

London: Stevens and Norton, 26, Bell-yard, Lincoln's-Inn, and 194, Fleet-street.

New Demonstration in Geometry.

Published this day, in 8vo., with Diagrams, price 3s. sewed,

ELEMENTS OF GEOMETRY: with a New Demonstration, not depending on any Postulate, that the Sum of the Angles of a Plane Triangle is equal to Two Right Angles. By J. D.

London: Longman, Brown, Green, and Longmans.

CONTENTS OF THIS NUMBER.

Description of Mr. Craddock's Parallel Double-Cylinder Locomotive—(*with engravings*) 265
Table showing the Comparative Effect of Steam when Generated under different Pressures, and Cut off at different parts of the Stroke..... 271
Table showing the Advantages of Working Steam Expansively in the Locomotive Engine 272
The "*Times*" and Steam Printing 272
Mr. George Stephenson's No-Patent Railway Break..... 274
A New and Practical Method of Ascertaining the Velocity of Projectiles. By Owen Rowland, Esq. 275
The Poetry of Steam..... 275
Description of Fenn's Eccentric Lever Brace—(*with engravings*) 276
Description of Hawkins' Patent Clip—(*with engravings*) 277
On Railway Buffers. By Mr. James Rock, Jun 280
Remarks on Calculating the Power and Expansion of Steam, with a Practical Application of the same to determine the Actual Working Power of the Engines of the *Washington* Steamer. By Thos. Oxley, Esq., C. E. 280
Messrs. Cunningham and Carter's Atmospheric Railway—Model Experiments 283
Adcock's Patent Spray Pump 285
Calendar of Specifications—(*continued*) 286
Weekly List of New English Patents..... 286
Weekly List of Articles of Utility Registered... 287
Advertisements 288

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

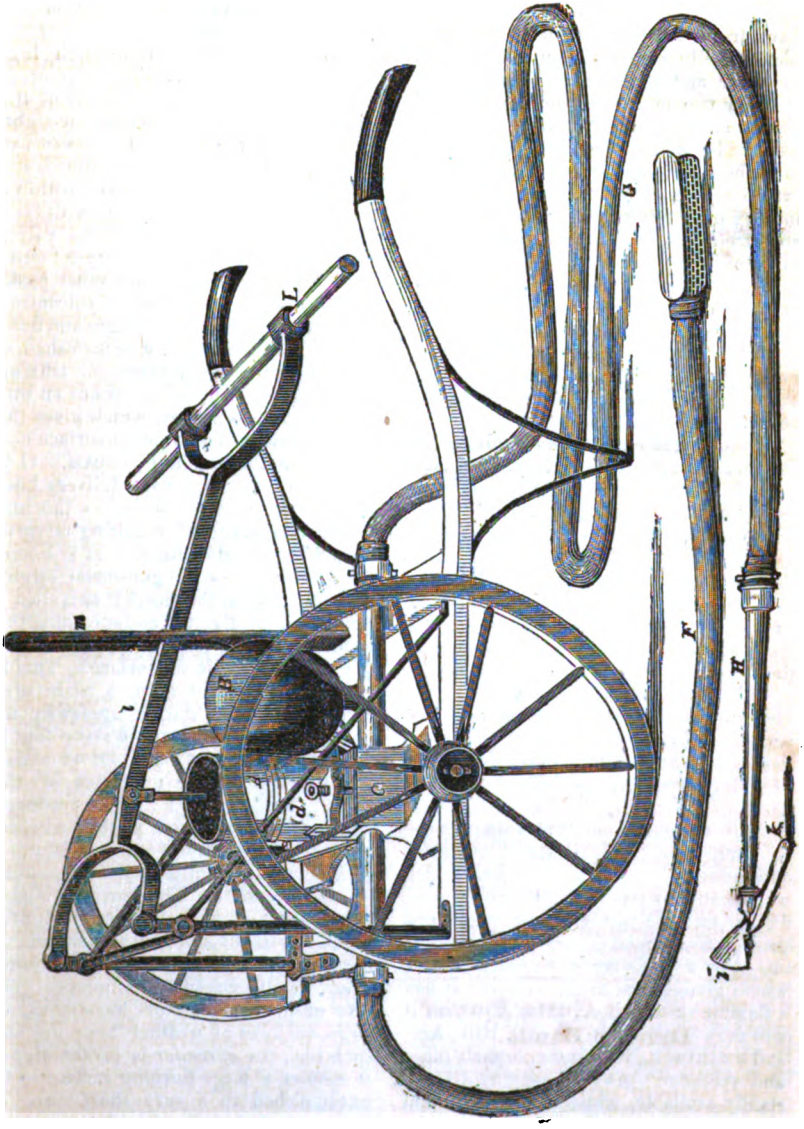
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1259.] SATURDAY, SEPTEMBER 25. [Price 3*d*.

Edited by J. C. Robertson, 166 Fleet-street.

MR. BADDELEY'S EVERYBODY'S FIRE-ENGINE AND UNIVERSAL FORCE-PUMP.



Digitized by Google

EVERYBODY'S FIRE-ENGINE AND UNIVERSAL FORCE-PUMP. BY MR. BADDELEY.

SIR,—In consequence of the frequent occurrence of fires in farms, I was led to attempt the construction of a Fire-engine which should be sufficiently simple, of adequate power, and so moderate in its cost, as to be suitable for farmers' use. My success has equalled my most sanguine expectations, and in the machine now submitted to your notice you have, in the smallest compass, in a complete travelling carriage, a machine equal in power and superior in efficacy to the ordinary run of *Parish engines*, at half the usual cost, and capable of being worked by half the number of men—a machine that is applicable to the roughest work of a farm without any fear of injury; not a thing about it, that requires any care or attention beyond the greasing of an ordinary cart wheel.

Derangement in the valves (the lungs or vitals of the machine) is almost impossible, but, should such occur, a ploughboy could put all right in a minute, and no repairs can become necessary beyond the capacity of a hedge carpenter to execute.

One of these engines was exhibited at the recent meeting of the Royal Agricultural Society of England at Northampton, as a "FARMER'S FIRE-ENGINE," but to which, in deference to the suggestion of a Nobleman who saw it there, I have since given the more appropriate designation of "EVERYBODY'S FIRE-ENGINE, AND UNIVERSAL FORCE-PUMP." In the Royal Society's Catalogue it was thus described:—

"*(New Implement.)* A Farmer's Fire-engine, Drainer and Irrigator; invented by W. Baddeley, of 29, Alfred-street, Islington, and manufactured by M. Merryweather, of 63, Longacre, London.

"This engine consists of a single barrel force-pump and air-vessel mounted on a light two-wheeled framed carriage, manageable by one man. It has perpendicular metallic valves arranged in a separate valve-chamber clear of the works, closed by a single screw, the loosening of which gives access to the valves. It has a flexible suction-hose, through which it will draw water from a pond, tank, &c., and a canvas delivery-hose, branch-pipe, and spreader. As a fire-engine it is instantly available, while it will be found exceedingly useful for emptying ponds, &c., and irrigating lands. It may be used to pump liquid manure from the tank to the cart, or from the cart to distribute it over the land."

In the accompanying figure, A is a gun-metal pump-barrel, within which works a solid metallic piston with cupped leathers. B is a spherical copper air-vessel. C the valve-box, clear of the works. *d* is a screw working in a cross-bar *e*, which is passed through lugs at each end of the valve-box; the pressure of the screw *d* on the cover of the valve-box makes it perfectly air-tight. On loosening the screw, the cover can be taken off, the valves examined and cleared, and the cover replaced within a minute, without interfering with any other part of the engine. The valves are of gun-metal with perpendicular faces, without leather or any other packing. F is the suction-pipe, of vulcanized India-rubber, perfectly air-tight and flexible at all temperatures: it is furnished at one end with a union screw for affixing to the engine; at the other, it has an improved rose or strainer, which gives the greatest amount of straining surface and strength in the smallest compass. G is a length of woven canvas-delivery hose (*Vaucher's patent*) which has the important advantage of requiring no care, beyond drying after using. H is a copper branch pipe with gun-metal screws and nosel; upon the nosel is swivelled a spreader *i*, for dividing and spreading the jet, so as to distribute it simultaneously over a large extent of surface. This is accomplished by bringing a plain surface, or fan, over the jet anglewise by pressing upon the lever *k*; the fan is at other times kept back out of action by a spring on the underside of the lever. An effect is thus produced superior to that from a perforated rose, while from the jet not being acted upon until after it has quitted the nosel, choking is impossible. This spreader is also thrown into or out of action instantaneously, without stopping the engine, as must be done when a perforated rose, scoop, or slit-spreader is employed. In case of fire in corn or hay-stacks, or large surfaces of weather boarding and such like, the *spreader* is invaluable, as it enables a large burning surface to be extinguished in a very short space of time with the smallest possible quantity

Digitized by Google

of water. Similar spreaders are now extensively employed by the fire-police in many provincial towns, and by the insurance companies. The engine is worked by three men placed at the handle L of the lever *l*, who can deliver a jet of water, three-eighths of an inch diameter, upwards of sixty feet high, or they may throw a larger jet to a smaller height. When in travelling order, the suction-pipe and delivery hose are both permanently attached to the engine; the suction-pipe being turned up and laid alongside the lever *l*; the delivery hose with branch-pipe attached, is coiled up and laid upon the upright guide *m*, the branch-pipe being laid alongside the suction-pipe, and both secured to the lever *l* by a single strap. In case of fire, all that has to be done is to *unbuckle one strap*, throw the suction-pipe into the water supply, and commence pumping!

Although this engine is but of moderate power, from the great rapidity with which it can be brought up and set to work, it would be far more efficient in arresting the progress of a fire than any more powerful agent applied at an advanced stage of the conflagration.

Now that farmers generally are becoming sensible of the vast importance of judicious draining and irrigating, as well as the great advantage of manures applied in the liquid state, an universal force-pump of this kind will be found invaluable for many purposes; and, in conjunction with that of which no farm should be destitute,—a good pond of water adjoining the homestead and stack yards—such an engine as the present would counteract all the worst features of incendiarism.

To gentlemen whose establishments do not require or warrant the maintenance of a more powerful fire-engine, the present offers much security and convenience, as well for extinguishing fire, as for watering lawns and gardens, filling cisterns, &c., &c. Small country parishes and villages are almost universally destitute of fire-engines, in many cases no such machine being within several miles of them; to places so situated, the present engine, at an easy cost, offers adequately to supply this lamentable deficiency.

I remain, Sir, yours, &c.,

WM. BADDELEY.

20, Alfred-street, Islington, September 3, 1847.

ON BALANCES. BY FRANKLIN PEALE, CHIEF COINER OF THE MINT OF THE UNITED STATES.

(From the *Franklin Journal.*)

In order to insure precision and regularity, to obtain facility and rapidity, and, above all, to avoid liability to error, it has been found necessary to combine, in the balances used in the mint, not only all the arrangements known to us that have heretofore been found important, but also such improvements as have been the growth of our own experience.

The result has been satisfactory, in a remarkable degree; so much so, as to be a subject of surprise to the most experienced of the corps of officers of this establishment.

In the present communication, no attempts will be made to establish claims of invention, either for ourselves or others. In fact, it would be impossible to do so with justice. Balances of every variety of structure have long been made, and may be readily met with; and all that we can now claim is, after much experience in their use, to have combined their best parts, and, in doing so, to have introduced such modifications and adaptations as have been found desirable.

In the balances of which this notice treats, two considerations have claimed particular attention: the first is precision, the second construction.

Under the former head, a descriptive notice will embrace remarks on such provisions and operations as are deemed important; and under the latter, a description of construction, illustrated by engravings of the balance, as erected, and of the separate parts in detail.

To obtain the greatest degree of uniform precision, it is requisite that the beam should be lifted from a state of rest in a perfectly level position, and that the stirrups should be lifted, simultaneously with their loads, from their rests or supports; also that the oscillations of the stirrups should be prevented or checked at the earliest moment; and, finally, that the whole system should be left at liberty with delicacy and exactitude, so as to remain in equilibrium or vibrate, as the case may be.

To command the above conditions, the beam should be supported upon cones, at each extremity, adjusted level with each other, from which it is lifted by a plane, which rises under its centre knife-edge, and to which it is returned by its depression, the cones guiding the beam to the same position exactly from which it was elevated.

The stirrups, in like manner, should hang upon hollow cones or V's, so as to be taken

Digitized by Google

up from, and returned invariably to, the same position.

The support for the centre-knife edge, as well as the hangers which rest upon the knife-edges at the extremities of the beam, should be planes, and not portions of hollow cylinders, as is usual.

The beam should rest upon its cones, and the stirrups should be supported by their V's at such heights as to relieve entirely the knife-edges, with a sufficient space between them and their respective planes to permit inspection and wiping, when it may be needed. This construction admits of the placing of the weights, &c., and guards the knife-edges from the consequences of displacement during use.

The beam should be raised by the elevation of the centre plane, subsequently lifting with it the stirrups, with their weights and load, and all oscillation checked by platforms placed in the table under the centre of the stirrups, which should be made to rise simultaneously, and should be counterweighted to the requisite delicacy.

The descent of these platforms, effected by the pressure of a finger on a lever conveniently placed, will leave the stirrups, &c., at liberty to vibrate, or bring the beam to a horizontal position, at the will of the operator; being a convenient, certain, and rapid method of manipulating, not equalled by any other arrangement, and, in fact, essential to a well-constructed balance.

The knife-edges should be constructed of the best cast steel, hardened to the utmost ability of that metal, and the planes upon which they bear should be made as true and perfect as possible; those for the finer or more elaborately-finished beams, should be of agate or chalcedony.

Having thus concisely stated the essential qualities in balances for accurate and rapid weighing, it will be proper to explain the construction by which these qualities are acquired, being the second branch of this essay. In explanation of this, reference is now made to engravings which accompany this notice: one, exhibiting a front view of the whole; the other, the parts separate and in detail.

Description of Engravings, with Explanatory and General Remarks.

Fig. T represents a front view of the balance, on a scale corresponding to a beam four feet in length, suited, in its proportions, to weigh one thousand dollars in silver. The weight to which it is limited should not exceed one thousand ounces troy.

A beam of three feet in length is suited to drafts of five thousand dollars in gold coin, and the maximum weight should not exceed, in any case, three hundred ounces troy.

The proportions exhibited in these plates may be maintained throughout for the above sizes, or any other, either greater or less, than those which are stated.

A table, marked A, is furnished with levelling screws upon the front and back edge, and at each end, marked *b*; the levelling screws are marked *b*, and their positions in the table (the view of the under side of which is given) are marked *c*.

The balance is intended to be placed upon a counter, or any other firm support, and the table levelled by means of the screws last described, its true position being indicated by a plumb-line and weight occupying the rear opening (*c*) in the column; the plumb-line and weight being marked *d*.

The column marked C contains the lifting apparatus, and supports the cap-plate, marked D. The cap-plate guides the lifting apparatus, and supports the V's, or hollow cones, for the stirrups, and is strengthened and stayed by braces, marked E; the section of which braces is cruciform, with circular ends, for firm bearing upon the plate and base of the column, to which they are secured by screws.

The remaining figures exhibit upper and under views of the table, column, plate, &c., also upper and lower end views of the column, showing the means of its attachment to the table and cap-plate.

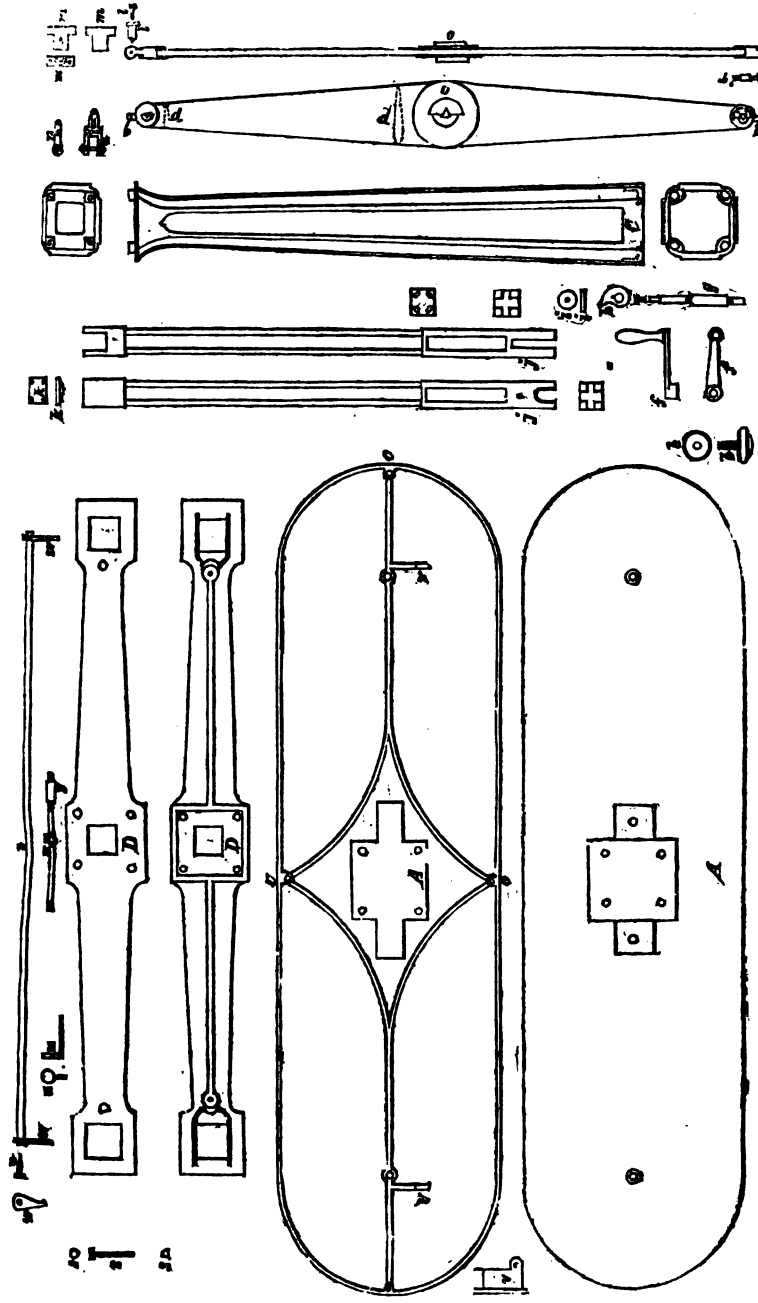
Balances intended for service alone may be made of cast-iron, exclusive of the beam. For small balances, or when higher finish and display is designed, bronze, or ordinary brass, may be used.

The lifting apparatus consists of a winch-handle, marked *f*, fitting upon a round shaft *g*, with a feather, so as to admit of its convenient removal; upon this shaft is fitted a cam *h*, also secured by a feather; the cam is carefully constructed, so as to give equal elevation to equal parts of its revolution; and upon the cam rests a roller *i*, which turns upon a pin in the frame *j*, intended to reduce friction, and give facility in raising the beam with its load.

The lifting-frame *j* is forked crosswise, so as to straddle the shaft and accommodate the cam and roller, at the same time that it allows the necessary vertical motion, without the possibility of being displaced; all of which is exhibited in the two views of the lifting-frame marked *j*, which is also accompanied by sections in proximity to the parts which they are intended to explain.

The handle is so placed as to be on the left when the beam is down and at rest, and to the right when the beam is raised, in the act of weighing, and makes, together with

Digitized by Google



Digitized by Google

the cam, more than three-fourths of a revolution, the cam having a very slight depression upon its upper or highest point, into which the roller falls, maintaining it in its position when the beam is raised. It is then extended beyond the centre of the roller, so as to be stopped at the limit of motion, as exhibited at the part *h*.

The lifting-frame is forked at the top for the accommodation of the beam. Upon it rests the plane, the top and side view of which are marked *k*, for the support of the centre knife-edge, secured to the frame by screws. In balances of ordinary construction, this plane may be made of hardened cast steel; in finer instruments, of bronze, or brass, with an inserted block of polished agate, secured by fusible metal, or cement.

The position of the handle, lifting-frame, &c., are exhibited with sufficient clearness in the front view, fig. T.

The cap-plate, fig. D, is constructed with horizontal spaces at the centre and each end. In the middle it is secured to the column by four screws, and to the braces B in the same manner, the holes for which are marked in all the views.

The square opening in the middle serves as a guide and support to the lifting-frame, which must be accurately fitted, so as to prevent any lateral play.

The horizontal spaces at the extremity of the cap-plate support short pillars terminated by cones, upon which the beam rests; these pillars are secured to the cap-plate by screws passing through it from the under side, the holes through which they pass being large enough to admit of the adjustment of the beam to its proper place, previous to their being permanently fastened down.

The details of these pillars are given in fig. *l*, the cones being constructed of cast steel, hardened and polished.

The same space also supports the V's, or guide supports of the hangers, the V's being marked *m*, and the hangers *n*. All these parts have been devised with reference to the simplest and most economical construction consistent with the requisite accuracy, and for affording the greatest facility in the final adjustment of the balance.

The most important part of the balance is the beam, the form and material of which, both with reference to use and construction, have been carefully considered. Fig. *o* exhibits side and top views. It will be observed that the beam is perfectly simple in its form, thickened at the centre and extremities, for the security of the knife-edges, the arms being diminished in depth, regularly, from the middle to the extremities, a section in any part of which would represent a sharp wedge, with its extremities rounded, as shown by the dotted lines at *p*, the thicker being the upper edge of the beam. The projections marked *q* are the supports of the beam when at rest; the conical cavities, indicated by dotted lines, being made to fit the cones marked *l*.

This form of beam affords facility in construction, being composed of straight surfaces without ribs, or curves; is well adapted to maintain its form when loaded; affords the least surface for accumulation of dust, and is readily wiped when it may be necessary. The means of adjustment for the length of arm is exhibited in fig. *r*.

As a general rule, convenient and accessible means of adjustment are to be deprecated. Balances should be constructed with reference to the use to which they are destined, and the necessary accuracy and sensibility given in construction. It will be found, it is believed, more inconvenient than desirable, to attempt to change the sensibility of a beam devoted to different uses. Again; a person might have sufficient mechanical skill to use a balance and weigh accurately whilst it is in order, who would be much embarrassed by the consequences of a change in the centre of gravity, affecting the accuracy and sensibility respectively, without consciousness of the cause, or knowledge of the effects. A repetition of the remark, that prominent and accessible means of adjustment are to be deprecated, will be excused, as having a tendency to invite to attempts at adjustment by the incompetent and unskilful, or it may be to derangement by the meddlesome.

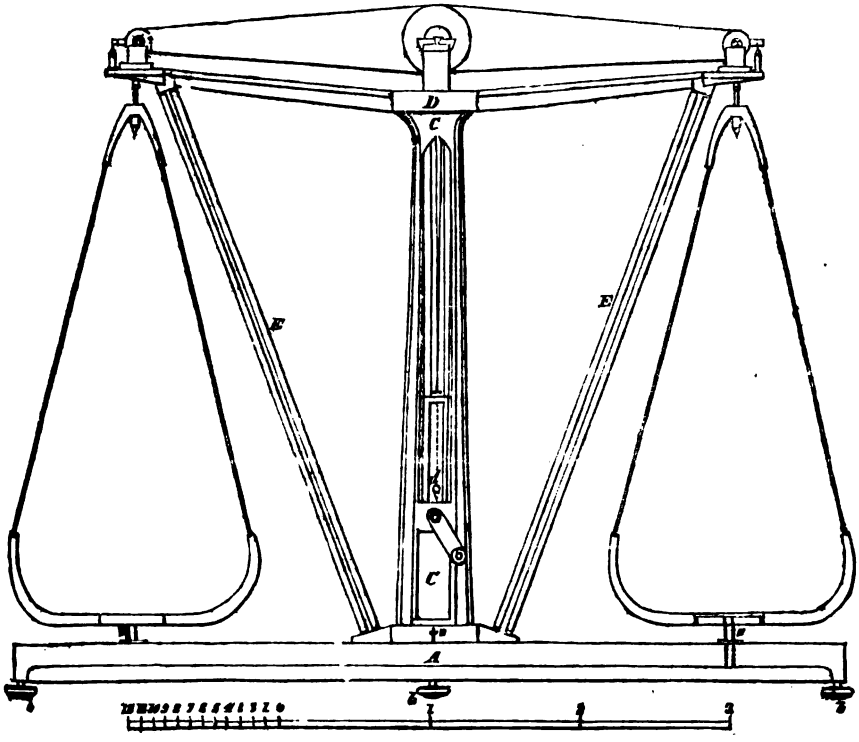
The material best suited to the construction of beams will depend upon the purposes to which they are destined. For mint usage they should be of roll brass, or a malleable alloy of copper and tin, well hardened by heavy hammering. The difficulty of procuring castings perfectly sound, and free from "blows," being a sufficient reason for the rejection of cast metal of any kind.

It will be seen that the needle of the balance, which is the subject of description, is pointed downwards, and there are good reasons for this disposition. In the first place it is directly before the eye of the operator, and therefore more convenient in use, than it is when elevated above. Again; it may be made longer than the arms of the beam, and will consequently describe a larger arc, and thus give more distinct indications, whilst the whole arrangement need occupy no more space than is requisite for the other parts; and, finally, the needle is protected from external injury by the lifting-frame and column, in the centre of which it is placed.

Digitized by Google

The parts which remain to be described have been usually considered of minor importance, but experience has shown that this estimate is scarcely a just one, inasmuch as they afford facilities for accuracy and rapidity that leave no doubt of their value, and place them in a most important position in practice. The parts now alluded to constitute the system by which the operator is enabled to find the equilibrium of which he is in search. It consists of the pedestals, as they have been termed, marked *s*, and the parts connected with them, marked *t*, *u*, *v*, and *w*; a light shaft made of tubular iron *t*, supported by pivots *u*, which pivots are screwed through a piece cast on the under side of the table, marked V; upon the ends of this shaft there are levers W, upon the ends of which levers, when in place, the pedestals rest.

Fig. T.



The remaining part of this system is a double-armed lever, placed in the middle of the shaft *t*, and marked *x*; it is connected by a pin with the trigger *z*, represented in its place in plate I, with the same letter. Upon the other end of the lever *x*, there is a weight *y*, capable of adjustment by a screw, upon which it traverses, so as to be approached to, or receded from, the shaft *t*.

The action of this system is easily understood; its whole object is to depress the platforms by sufficient force, applied by the finger to the trigger, the counter weight returning them to their original position after its removal.

It will be seen, by reference to the figures, that the under sides of the stirrups have a space represented by dotted lines, in which the platforms are placed, which allows the stirrups to oscillate within its limits, but beyond which they cannot move. This construction is intended to guard the hangers from displacement, and to prevent injury by too much movement of the stirrups; an accident very likely to occur when the pans or weights are hastily removed, especially in the use of the larger balances with heavy weights or large masses.

The cavity, whose object was described in the last paragraph, forming the under side of the base of the stirrups, is turned as truly as possible in the form of a portion

Digitized by Google

of a sphere, whose radius is its distance from the bearing of the knife edge. The platforms are adjusted by means of the counter weight, so as to press lightly up against the stirrups, and to follow them when raised.

It is found convenient in practice to turn the handle of the balance but a small portion of its movement, if the weights are not equal on opposite sides, a circumstance to be expected when searching for a weight. The heavy side will remain down, and the needle will indicate whether addition of weight, or its removal is requisite. These trials are continued until the platforms follow up the whole lift, the needle remaining opposite the middle line of its scale, until the handle is stopped by its limit of motion, where it remains. The finger, then, by pushing down the trigger, will depress the platforms; when smaller weights are employed, until the needle indicates equilibrium.

In this balance there is little or no embarrassment from oscillation, because the stirrups immediately accommodate themselves to the position of the weights, the light pressure permitting them to take any position required by the load; nevertheless, having sufficient power from their pressure to prevent any swinging. If from any cause the stirrups should be in motion, three consecutive depressions of the platforms will bring them to a state of rest with absolute certainty, and with a loss of time so short as to be entirely immaterial.

The stirrups are connected with the hangers by a rod, which are double-jointed, as near to the hangers as possible, so as to allow perfect freedom of motion; at the same time, so well fitted as to allow no change of position in the parts. On the lower ends of these rods, there are screws and nuts, to regulate the height of the stirrups, together with a jam nut, to prevent any change after the adjustment has been satisfactorily made.

The bases of the stirrups are designedly made small, requiring the use of a dish on the one side, and a platform for weights on the other. This dish and platform being made of equal weight, renders the use of a counter weight unnecessary; and as the balance cannot be used without both, the liability to mistakes from this cause is entirely avoided.

For the adjustment of weights, or any other use of balances requiring the greatest degree of delicacy and care, it is necessary to protect the instrument and the operation by a case, with doors sliding vertically, and glazed, so as to permit inspection, undisturbed by currents of air. This arrangement, entirely essential for such uses, is inadmissible for ordinary weighing, involving too much delay in the necessity for opening and shutting the doors.

In the balance for weighing gold coins, which was placed in the exhibition of the Franklin Institute in 1846, and which is now in use in the weighing and counting-room of the chief coiner's department in the Mint of the United States, all the parts, with the exception of the stirrups, are covered by plate glass, inserted into the framing, so as to protect the balance as much as possible from currents of air, dust, and external influences of all kinds. This balance has been made, with the utmost care in all respects, upon the principles detailed in the foregoing notice, and the result has been satisfactory in the highest degree. In illustration of which, it may be stated, that with its maximum load of six hundred ounces, three hundred on each side, it is sensible to the ten-thousandth of an ounce. This fact is not mentioned as very remarkable, because it is comparatively easy to give great sensibility to balances: but it is worthy of note, that it is invariable in showing this minute fraction of its load. As regularity is of the greatest value in operations with balances, we may be excused for drawing attention to a quality of so much importance.

HORÆ ALGEBRAICÆ. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from page 152.)

IV. CLASSIFICATION AND NOMENCLATURE—IMPOSSIBLE EQUATIONS—SYMBOLS.

According to the aspect under which we regard them, the various kinds of problems to which the title INDETERMINATE is in general applied, admit of separation into two great classes—the ARITHMETICAL and the SYMBOLICAL.

Under the former division would come those questions in which we are required to satisfy certain conditions by quantities of a given numerical form; take, by way of instance, DIOPHANTINE analysis (*a*).

To the SYMBOLICAL class of indeterminate questions belong those in which

---

(*a*) Professor J. R. Young, at p. 259 of his *Algebra* (London, 1834), observes that "DIOPHANTINE Algebra is that part of analysis which relates to the finding particular rational values for general expression† under a surd form." He separates the Diophantine from the other indeterminate problems.

† This is evidently a misprint for "expressions" and is corrected in the last edition. The sense is inverted by the omission of the "s."

Digitized by Google

the indeterminateness of the problem is made the means of satisfying certain *symbolical* conditions. Besides the many isolated instances in which advantage may thus be taken of the indeterminateness of a question (*a*), there are two uniform and general methods in which the solution of certain algebraic problems of this class is reduced to a systematic form and course of procedure. I allude to the method of Mr. Jerrard (*b*), and to my own method (*c*). Were I called upon to suggest a name for Mr. Jerrard's analysis, I should propose to term it the METHOD OF VANISHING CO-EFFICIENTS; while for my own (which is a kind of SYMBOLICAL DIOPHANTINE method), I think the name DIOPHANTIC METHOD, or METHOD OF VANISHING GROUPS, would not be inappropriate.

Some instances of the application of the *method of vanishing groups* to analytical geometry will be found in the last volume of this work (*d*).

In that volume (*e*) I have also touched upon the subject of a class of equations, an individual of which I have discussed in the present set of papers. The class which I allude to is that of IMPOSSIBLE equations. By the term "impossible," I must not be understood to mean arithmetic impossibility. In the latter sense of the word, a quadratic with two unreal, imaginary, or "impossible" roots, would be an "impossible equation." But such an equation is only *arithmetically* or *numerically*, not *algebraically* impossible: while by the term IMPOSSIBLE, as used at page 123 of the last volume of the present periodical, I mean to denote an equation *algebraically* or *absolutely impossible*; and in such sense I shall continue to use the words "impossible equation."

The simplest instance of an impossible relation will perhaps be found in what we may term the INCONGRUITY $1=2$. And an example of an impossible equation will be found in the equation (4) of page 151 of the present volume. But, as we have seen at that page, the absolutely or algebraically impossible equation (4) may be shown to involve an impossible relation or INCONGRUITY similar to the one just given. And it is not easy to see how an equation can be algebraically or *absolutely* impossible, unless it involve some contradiction or inconsistency expressible by means of a numerical or arithmetical incongruity. In fact, a reflection on the investigation of page 151, suggests almost irresistibly the following proposition,—viz., that *whenever the solution of a given equation is absolutely impossible, that equation involves in itself a numerical incongruity.* Remarks on any supposed converse of this proposition are quite unnecessary. But I shall probably have an opportunity of saying more on this proposition itself when I come to continue and generalize the discussion of page 151 of this volume.

My present object is, however, to revert to a subject the discussion of which I commenced in the last (*f*) and have continued in the present (*g*) volume —that of the meaning of symbols, or, as Mr. Woolhouse has termed it in the course of some remarks upon a different description of questions, "the general theory of analytical results" (*h*).

Upon the controversy between Mr. Young and Mr. Woolhouse I wish to be understood as offering no opinion whatever. My only wish is to avail myself as well of the labours of the latter distinguished mathematician as of the able philosopher of Belfast. And much of the controversy has a bearing upon the discussion just alluded to.

Mr. Woolhouse remarks (*i*) "that the original equations, which express the analytical conditions of a problem, cannot include any extraneous conditions with those expressed in the enunciation, and that they must therefore comprehend, in their analytical results, every solution that the problem is capable of receiving. The equations, however, may not include certain other implied conditions, dependent on the peculiar nature of the inquiry, and therefore may yield some additional solutions incompatible with the conditions so implied." Hence,

(*a*). For examples of this see *Mechanics' Magazine*, vol. xlvi., pp. 177—178; and page 419, right hand column.

(*b*) See his *Mathematical Researches*; see also his papers in the *Philosophical Magazine*, s. iii., vol. vii., pp. 202—203; 478—480; vol. xii., pp. 345—347.

(*c*) For which see *Mathematician*, vol. i. page 114; vol. ii., page 97.

(*d*) See the places cited *supra* page 150, note (*b*).

(*e*) Page 123.

(*f*) Pages 490, 516. (*g*) Pages 13, and 135.

(*h*) *Phil. Mag.*, s. iii., vol. viii., p. 399. (*i*) Ibid.

Digitized by Google

as a general rule, we shall have, from a number of results, to select those of which we are in quest. But what is to be our guide in the selection or exclusion of results? Mr. Woolhouse would reply (*j*); "The exclusion of inadmissible solutions" "rests with the nature of the problem and not with the forms of its analytical conditions." And this would also, if I am not mistaken, be the reply of Professor Young. In referring then to a "scrutiny of the symbols," (*k*) as a means of discriminating the true result, I have the appearance of differing from both the authorities above alluded to. To avoid the semblance of being in a position which would afford so strong a presumption that I was in the wrong, I beg to say that, without denying that we must refer to the conditions of the problem in order to obtain a true result, the question with me is how far we can carry those conditions through all our subsequent operations and up to the final result—how far we can "take the expressions *immediately* deduced in the investigation" (*l*) to use, what I believe to be, Mr. Woolhouse's own words—in short how far we can take those expressions, and those only, which are the solutions of which we are in search.

In such a result as that obtained at page 517 of the last volume (*m*) I see nothing discouraging (*n*). The difficulties which arise commence with *irrational* or *congeneric surd equations* to which we have been conducted in our researches on symbols. And before we proceed further with such researches it will be as well to endeavour to obtain a little further insight into the nature of surd equations, to the further discussion of which I shall proceed in another paper.—(*To be continued.*)

The following corrections should be made in my papers in the preceding (xlvith) volume of this work:

Page 124, col. 2, line 4 of the note, *for* × *read* +.
Page 179, col. 2, line 3, *for* y *read* y^3.
Page 247, col. 1, line 14, *for* "isololated" *read* "isolated."
Page 492, col. 2, line 3, *for* B′ *read* B^1.
Page 563, col. 2, line 16, *for* "*Nouveax*" *read* "*Nouveaux.*"
Page 569, line 2 of my *Postcript*, *for* "*notes*" *read* "*Notes.*"
And the following in the present volume: Page 151, col. 2, line 14, *for* (3) *read* $F(x)=0$.

(*j*) *Phil. Mag.*, s. iii., vol. viii., p. 399.
(*k*) *Supra* page 13.
(*l*) *Phil. Mag.*, s. iii., vol. viii., p. 298.
(*m*) See the question in col. 1.
(*n*) We may call 40 the *primary* and 60 the *secondary* solutions.

MR. CRADDOCK'S STEAM-ENGINE IMPROVEMENTS.—THE COMPRESSED AIR SYSTEM.

Sir,—All the essentials in the plans and arguments Mr. Craddock has advanced in favour of high-pressure steam, have frequently been enforced in our periodical literature during the last ten years. For instance, it has been shown that fuel may be reduced two-thirds, and the twofold saving thus effected in a voyage to New York, in cost of fuel and tonnage, have been likewise noted, that two cylinders are necessary, and that *one* slide-valve only is required for working them (which, I believe, is a patented claim); that the safety of high-pressure steam, with divisional boilers, is, both by calculation and reasoning, very much greater than the low-pressure chambers now in use; that the quantity of steam to be condensed will only amount to one-third in relation to the power exerted; and that, if it is expedient, after effecting so large an amount of saving, as two-thirds, to change the power of the engines in accordance with the state of the weather, the best practicable mode is, by working a greater or less number of fires, and thereby varying the pressure in the boilers, by which expedient the number of expansions will always remain constant, and the cost will always be in the ratio of the difference; and that the engines—the preceding precautions being carefully attended to—will be worked, as regards fuel, at the least possible expense, which is not the case in working with expansive gear. Giving motion to the condensing pipes, I think is new, and probably valuable; for one of the greatest essentials to the introduction of divisional boilers, is the indispensable use of *pure water*. To this, and the fears entertained of high steam, occasioned by the improper construction of boilers for its production, is to be attributed in a great measure the strong prejudice which has hitherto opposed its introduction. But the first vessel sent across the Atlantic, with well combined machinery, and with the high-pressure expansive principle fully developed, will commence a new era in steam navigation.

Allow me to offer a few remarks on the compressed air system. In compressing an elastic fluid into a smaller space, it is quite clear that as much power will be required to effect it, by the most suitable machinery, independent of fric-

Digitized by Google

tion, &c., as it can possibly return by the most perfect system of expansive action in its application as an impelling power; consequently, if a fluid so compressed be applied to a piston *wire* drawn from the chamber, the power so applied will be many times less than the cost of compressing it, and the loss enormous, as compared with the use of steam direct from the boiler.

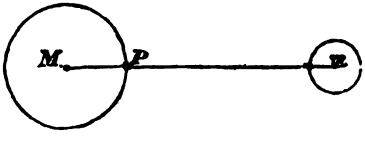
I am, Sir, yours, &c.,

ALPHA.

Limehouse, London,
Aug. 24, 1847.

THE EXPRESSION FOR ACCELERATION (P. 231) SIMPLIFIED.

Sir,—As every attempt to illustrate or explain a difficulty finds ready admittance into your useful columns, perhaps the following illustration of the expression for acceleration given in col. 1, page 231 of the current volume may not be unacceptable to some of your junior readers:



Let M and m be the masses of the earth and moon; P a given particle or body on the surface of the earth: put M P = R, and m P = r. Then, since the acceleration is as the masses directly and as the squares of the distances inversely, we have

Accel. force of M = $\acute{F}$: Accel. force of m = B : : M : m, when *both* masses are supposed to be at the distance r.

$$\therefore \acute{F} = B\,\frac{M}{m} \ldots\ldots\ldots (1).$$

Also, Accel. force of M = A : Accel. force of M = $\acute{F}$: : $\frac{1}{R^2}$: $\frac{1}{r^2}$, when the mass M is supposed to be in *both* positions M and m.

$$\therefore A = \acute{F}\frac{r^2}{R^2} = B\,\frac{M}{m}\cdot\frac{r^2}{R^2} \ldots\ldots\ldots\ldots (2).$$

This is the same expression as that given by your able correspondent, "A. H.," in the passage cited. From (2) we have $B = A\,\frac{m}{M}\cdot\frac{R^2}{r^2}$; and if, as directed, we take M = 1; R = 1; and the known accelerative force of the earth at its surface = A = μ = 32·2, we obtain $B = m\frac{\mu}{r^2}$; where m and r are the units of mass and distance as measured by the units M and R respectively. The same proportion for A and B as in eq. (2) might also have been obtained by considering that when the *distances* are equal the forces are as the *masses;* when the masses are equal the forces are inversely as the squares of the distances; therefore, when *neither* are equal, the forces must be as the *product* of the *masses* into the inverse squares of the *distances*. Perhaps *both* methods will not be considered unsatisfactory.

"A. H." deserves the thanks of every teacher and student of mathematics, both for his valuable and instructive "Remarks," and his illustration of the *correct* meaning of the series for the sine and cosine of any angle. Hoping he will excuse my attempt to *explain* his *explanation* of attraction,

I remain, yours respectfully,

THOMAS WILKINSON.

Burnley, Lancashire, Sept. 20, 1847.

A METHOD OF DESCRIBING THE EVOLUTE OF THE ELLIPSE.

Sir,—Having frequently required the evolute of the ellipse, I have adopted the following method of describing it, which is independent of all calculation. Let a, b, be the semi-axes major and minor C A, C B of the ellipse B L A. The equation to the ellipse is

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = 1,$$ and the equation to its evolute is

$$(ax)^{\frac{2}{3}} + (by)^{\frac{2}{3}} = (a^2 - b^2)^{\frac{2}{3}} \quad (1).$$

If a straight line move so that its two extremities are always in two straight lines at right angles to each other, it will always be a tangent to the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = r^{\frac{2}{3}}$ (2) where r is the length of the moving line.

Equation (1) may be put under the form

$$x^{\frac{2}{3}} + \left(\frac{b}{a}y\right)^{\frac{2}{3}} = \left(\frac{a^2 - b^2}{a}\right)^{\frac{2}{3}} \quad (3).$$

Digitized by Google

Take r such that it

$$= \frac{a^2-b^2}{a} = \frac{a^2e^2}{a} = \frac{SC^2}{CA}$$

$$= \text{also } a - \frac{b^2}{a} = AC - SL.$$

With centre B and radius AC describe an arc cutting AC in S. Then S is the focus. Take CH = CS and through S draw SG ∥ AH.

Then, $\frac{CG}{CS} = \frac{CH}{CA} = \frac{CS}{CA}$ or $CG = \frac{CS^2}{CA} = r$.

Draw the lines $a\,a$, $b\,b$, $c\,c$, $d\,d$, each equal in length to r or C G, and describe the curve Q p R, so as to touch each of these lines. If in equation (2) and (3) we make X = CM = x, we must have

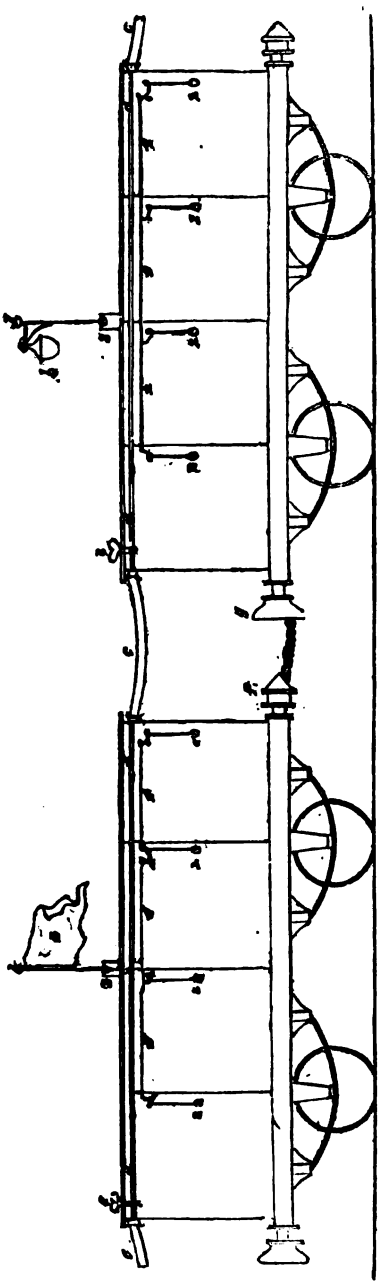
$$\frac{b}{a}\gamma = y = M\,p, \text{ or } M\,P = \gamma = \frac{a}{b} M\,p.$$

Any additional number of points may be found in the evolute by giving any other value to X and x than CM. When a sufficient number have been found the evolute Q P T may be struck so as to pass through them, and be a tangent to the axes of x and y at Q and T. With ordinary care the result will be as accurate as if independent calculations had been made from the equation to the curve for every point actually taken.

F. Bashforth.

RAILWAY SIGNALS.

Sir,—I had the honour in the early part of June to submit to the public, through the medium of your valuable publication, a plan for effecting communication between vessels at sea, &c., and between passengers, guards, and engine-drivers upon railways. I did not at that time enter into the details of my plan to the extent I should have wished, and was prepared to do; subsequently however I addressed myself to the Commissioners of Railways, with a full description of my plans, but was informed that they had no power to interfere, and advised an application on my part to some railway company. I made an application at the time to the chairman of a railway company, but, I am sorry to say, without experiencing much encouragement. I merely state these facts in consequence of a claim made by the editor of a Sunday paper to the merit of having first suggested one of the leading features of my plan.



Digitized by Google

However, I am not disposed to relinquish my long-cherished plan, and will, with your permission, avail myself of your valuable pages to lay before your readers its details, relying upon their kind indulgence in overlooking its many imperfections. I humbly beseech them to encourage and not disdain this feeble effort to assist in promoting the adoption of means to effect so desirable an object.

Let there be fixed upon the roof of every carriage a small staff, moving on a fulcrum, with a flag attached to the long arm thereof; and from the short arm let a wire or rope be carried into every compartment of the carriage, to act as a bell-rope; so that, in case of accident or illness, the passengers, by pulling in the rope, could raise the flag-staff perpendicularly from its horizontal position, thereby giving a signal of danger to the guards. For night signals, the ordinary lamp of the carriage would be substituted for the flag. And for effecting a communication between the guards and the engine driver, I would suggest the following simple and inexpensive means:—Let a small lead, tin, or copper tube be laid the whole length of every carriage; and for connecting the tubes between the carriages, so as to form a continuous tube the whole length of the train, I would have a piece of gutta percha tubing inlaid with a spiral spring. One end of the long tube would be fixed to the steam pipe, so that a jet of steam could be made to traverse the whole length thereof, and escape at the distant end. At the seat of every guard a stop-cock would be fixed in the tube, so that he could on perceiving a signal of danger, stop the current of steam, which would then ascend a branch pipe furnished with a whistle, near the engine-driver, and cause the same to sound, or remove a detent from a bell machinery. This tube would, in the case of a carriage running off the rails, or becoming detached, be self-acting; for the elongation, and consequent collapsing of the gutta percha and the spiral spring, would stop the current as effectually as the "*stop-cock*," and cause the same result. Arrangements in connection with the engine could be made to cause a current of air to traverse the tube in substitution for steam, if it were more desirable—the intersecting tubes of gutta percha, &c., could be instantly attached and detached by the adoption of slides, &c.

Giving false signals could be rendered by a by-law a misdemeanor, &c.; such cases I am inclined to believe would be few and far between; and as this is one of the principal objections to the introduction of the means of communication upon railway trains, I beg to refer those men of *evil thought* to the falsity of their predictions as to the security from mischievous acts of the suspended wires of the Electric Telegraph, which have hitherto remained unmolested. Let the experiment be tried, and the result will justify them in commending or traducing the national character;—and not till then. You will be ready to say, Sir, that my letter partakes of the elasticity of my gutta percha tube, and like it, when overdrawn, I must stop the steam and give way.

I remain, Sir, yours, &c.,

OWEN ROWLAND.

11, Heathcote-street, Mecklenburgh-square, September 20, 1847.

Description of Engravings.

a Day signal of danger.
b Night signal do.
c The gutta percha connecting tubes.
d The fixed tubing along the carriages.
e The stop-cocks.
f The convex buffer.
g The concave do.
1 1 Flag and lamp staffs.
2 2, &c. Handles.
3 The fulcrum of the staff.
4 The strings or wires for raising the signals.

ON THE MILL-GRINDING AND HYDRAULIC PRESSURE PROCESSES OF EXTRACTING SUGAR FROM THE CANES. BY HENRY CROSLEY, ESQ., C. E.*

The operation of extracting or squeezing out the juice of the sugar cane (but *a part only*) is universally accomplished by vertical and horizontal sugar mills, generally of three rollers, of diameter and length varying according to the opinion of the proprietor of the estate, or his representative. In some colonies a mill with four vertically-placed rollers is used, and preferred to the horizontal mill of three rollers; as by the former the canes are *thrice nipped* or squeezed, in

* From "A Treatise on the Manufacture of Sugar, Presented to the Royal Agricultural Society of Jamaica. June 1844." Also, "Observations on Recent Improvements, &c." By Henry Crosley (H. Crosley and Co.), engineers, Emerson-street, Southwark.

Digitized by Google

lieu of *twice*, by the latter; and those persons who use the mill of four rollers consider that they obtain, by the *extra* nip, a proportionately increased quantity of juice; while those who use the horizontal rollers closely set, assert that they obtain more juice in consequence of the horizontal mill being fed more equally, and also worked with the same or less motive power than that required for the vertical mill of four rollers. But without descanting on the merits of either of these mills, it is unanimously agreed, that, with the best constructed sugar mill, worked to the extent of its capability, some portion of the cane juice still remains in the megass; and hence, to obtain the residue, improvements (as they are termed) have been made in constructing sugar mills with five, six, and even seven rollers; the latter by an eminent French engineer, but abandoned by him in consequence of the increased cost and great power required to work such a mill; which must be evident, because, *in proportion to the surface of the rollers* acting upon the canes, the *friction will be increased*, and therefore *extra power* would be required to work this mill. The extraction of the *whole* of the juice has been objected to by some persons, who consider that by so doing the megass would be useless for fuel—and none is equal to it for the battery of sugar pans as they are now generally fixed and worked; and if it can be proved that SUGAR is of *less value* than COAL (which, although not suitable for the old battery of fire pans, it is available for steam pans), then the advocates for a *moderate squeezing* of the cane are right. But a little reflection should convince them that their opinion is erroneous. The object of the planter is generally to grind canes as quickly as possible; and recently a Mr. John Biggs, civil engineer, of Jamaica, has advocated and recommended, in a pamphlet published by him in England, that the speed of the rollers of the sugar mill should be increased from four to seven and a half revolutions per minute; and he states, in page 14, that with six instead of four, he had obtained the extra quantity of 200 gallons of juice per hour, which of course must be from the *extra quantity of canes* passed through the rollers during that period; and it will be found by calculation, that the quantity of juice obtained from the *extra* quantity of canes passed through the rollers, was increased in, about the proportion of 4 to 6, the speed of the rollers; therefore the supposed advantage was an illusion. The object is, and must be, *to obtain the greatest quantity of juice from a given quantity of canes*, and *not to pass them through the mill regardless of quantity*. It is needful to obtain a certain quantity of juice within a limited period, but this must not be effected by the sacrifice of canes, which yield juice proportionately less when they are passed through the rollers at a *quicker speed*; therefore, in the experiment of Mr. Biggs, although he obtained a greater quantity of juice within the period named, still, had he passed the canes through the rollers at a *slower speed*, he would have obtained more juice than the quantity he did obtain, because, the *nipping power of the rollers* would have dwelt *longer* upon the canes. The *proper speed* of a sugar mill is *not to be determined by the revolutions of the rollers* on *their gudgeons*, but by the *speed of the peripheries of the rollers*. Engineers and other persons, acquainted with the milling of sugar canes, consider that 25 feet per minute is the proper speed; but the operations in the boiling-house ought to be the guide as to the working of the sugar mill, as any excess of juice not immediately operated upon becomes deteriorated, and hence arise considerable drawbacks in the after operations. The speed of 25 feet surface of the peripheries of the rollers per minute *is wrong in principle*, be the quantity of juice obtained what it may. The criterion of advantages of the sugar mill ought to be estimated by the *weight of canes, and not by the bulk*; because, as has been proved by experiments made in Cuba—

> 100 lbs. of canes passed between rollers rotating ten times per minute yielded 50 lbs weight of juice;

and by the experiment immediately following—

> 100 lbs. of the same sort of canes, and the same mill, the rollers rotating only three revolutions per minute, yielded 74 lbs. weight of juice.

Consequently, it must be admitted that the present mode of squeezing the juice from the cane, by the best mills, and at the usually considered proper speed, is a defective method.

And again, this is corroborated by a statement of an analyzation made by an eminent French chemist, who ascertained that the sugar cane ripe, and in good condition, contains 90 per cent. of liquid matter or juice, and only 10 per cent. of solid or fibrous; therefore, if 50 to 60 per cent. of juice is extracted (as is supposed) by the horizontal mill, worked at the usual and supposed proper speed, there must remain in the megass, even by the most advantageous workings, from 30 to 35 per cent. of liquid matter. But there are other cogent reasons for believing that the juice remaining in the megass is richer in saccharine matter than that first expressed from the cane, and this belief is

Digitized by Google

founded upon the assertion of a scientific gentleman many years a resident in Cuba, who, upon dissecting, as he did, a ripe cane just cut from the field, discovered with a microscope small crystalline deposits in the cells of the fibres; therefore it is reasonable to presume, that the richest or solid portion of the saccharine matter remains in the megass, and from these data may have arisen the recent invention (noticed by the editor of the *Kingston Morning Journal* of the 25th of January last) of the application of hydrostatic pressure as a substitute for the sugar mill; and as the writer has obtained the results of experiments made in St. Vincent during the last crop, and also those recently made in England, upon sugar canes, he states them in corroboration of the foregoing remark as to the present inefficient system of squeezing the canes by a sugar-mill.

Firstly, In St. Vincent, with an hydraulic press of 1000 tons power (worked by two pumps), presenting a surface of 25 square feet on the follower, or table, on which the canes were laid, they were only partially squeezed, in consequence of the press and pumps not being suitably constructed, and the manipulations improperly performed. The juice which flowed from the press, when compared with that from the roller mill, was as fine-conditioned pale sherry wine is to muddy water, and the expressed juice did not ferment so quickly as the mill juice; but it was found that a portion of the juice remained enclosed in the centre of the mass of canes, which were not pressed so effectually as they would have been had those causes not existed.

Again, a certain quantity of canes were passed through the mill, the rollers being set so closely, that the megass was torn into small pieces, and the produce was 94 gallons of juice. The megass was then subjected to hydraulic pressure, and 10 gallons of juice obtained from it.

Secondly, In England, in February last, sugar canes were subjected to a better constructed and more powerful press, of 1400 tons power, worked by four pumps, the surface of the follower 14 square feet, and the pile of canes nearly twice the height of the pile operated upon in St. Vincent, and in bulk about the same. By this last experiment, the follower or table of the press was run up 7 feet in eight minutes, by the power of six men at the double-ended lever handles of the pumps; but it is considered, that where manual labour is scarce, they could be worked by two mules, or by a small steam-engine of two horse power. It therefore appears, that, by the first experiments in St. Vincent, although the canes were greatly reduced in bulk, yet in the centre of the mass some portion of the juice remained; but by the last experiment in England, this disadvantage was surmounted by placing horizontally amongst the canes six strong iron pipes of 1 inch bore, the surfaces perforated with holes, by which means the pent-up juice escaped from the centre of the mass, and the WHOLE was discharged from the canes, which, as it is said, were perfectly dry. The megass had the appearance of a solid block of wood; and upon trying pieces of it in a vice, not one drop of juice could be extracted. Therefore it is reasonable to presume that this improvement will supersede the use of sugar mills, the rollers of which only give the canes an instantaneous nipping SQUEEZE at the point or surface of curvature of the rollers; whereas, with hydrostatic power, the PRESSURE is insistent in one line of direction, whereby the canes are riven lengthwise with the fibre; and as the nipping squeeze of rollers discharges the resinous substance in the rind of the sugar cane, which commingles with the juice when heat acts upon it, the quality of the sugar is thereby additionally injured; but, if the hydraulic press is employed, the resinous matter would not operate detrimentally, or, as it is supposed, not to the same extent.

Such are the methods now used and proposed for expressing the juice from the sugar cane. Other and perhaps less efficient means might be employed, but as these have been only partially tested in principle upon other substances, and not upon sugar canes, and as they are in a great measure the eductions of the writer's mind, he refrains from detailing them, considering that the pressing system, from its simplicity and efficacy, must eventually command a preference.

Note.

The application of hydraulic presses as substitutes for the sugar-cane mill, has been previously expatiated upon, and as such *supposed* improved method has not been adopted, it is necessary to explain why, and to state the causes that led to the promulgation of that method, as stated in pages 4 and 5:

In February 1839, in my pamphlet—"Suggestions" (which I gratuitously presented to the West India Proprietary), at pages 18 and 19 I alluded to the inefficiency of hydraulic pressure for discharging the juice from rasped beet root, and by inference concluded that that pressure would not be applicable to expressing the juice from the sugar-cane; nevertheless, in March, 1844, it was reported to me by the parties especially interested in the method for substituting

Digitized by Google

hydraulic presses for the cane mill, that by an experiment reported to them by the projector of the new method, that he and the person charged with the construction of two hydraulic presses of the supposed power contracted for, viz., each 1400 tons, subsequently sent to St. Vincent, that upon trial with sugar-canes purposely imported, the juice had been wholly discharged, and that the mass of expressed canes were as dry as a block of wood. The trials made in St. Vincent with these presses upon canes just cut, did not yield such result; and, moreover, it has since been ascertained, that the said hydraulic presses were each of them of the power of 600 to 700 tons only; and, consequently, the report of the trial made in this country on the stale sugar-canes must have been erroneous. It was upon the faith of such report being correct, (*although doubted by me,*) that I was induced to make the remarks upon hydraulic pressure, as stated in the preceding pages of this treatise; but even supposing and admitting that the juice in the cane could be discharged by hydraulic presses, *many would be required*, and the POWER EXPENDED TO WORK THEM WOULD BE PRECISELY THE SAME POWER NECESSARY TO WORK A CANE MILL, TO YIELD THE SAME QUANTITY OF JUICE. The slow motion of the hydraulic press could only be compensated for by employing many; and, as speed is only to be obtained at the expense of power, it follows, as a matter of course, according to mechanical principles, that were hydraulic pressure adopted in lieu of the sugar mill (which would be far less costly than presses), to obtain a given quantity of juice in a given period, the *same amount of power must be expended to work the presses* as would be necessary to drive the mill, and with the additional disadvantage that much more labour would be required for pressing.

In the body of this treatise, the operation of grinding the sugar-canes, and thereby squeezing out the juice, by the common and disadvantageous method used of driving the rollers of the mill at an improper speed, is descanted upon, and a statement given of the quantity of juice obtained from 100 lbs. weight of canes, passed between the rollers of a mill rotating at three and at ten times per minute; and that by the quickest rotation 50 lbs. weight of juice was the product, while 74 lbs. was obtained by the slowest rotation. The rotation of the rollers, which vary in diameter according to the size of the mill and the power to work it, ought *not* to be the criterion, but the proper *number of feet of surface the peripheries of the rollers rotate per minute* ought to guide the operation of grinding the canes; and although a slow rotation may not appear to be beneficial, as dispatch is a desirable object, still the ON-DWELLING OR ENDURING PRESSURE thereby obtained, would amply compensate, as the product of juice would be increased proportionately to what it would be were the peripheries of the rollers rotated at the *usually quick and injurious speed.* The *quantity of* CANES ground in a given time *ought not to be the desideratum*, but, on the contrary, the *greatest quantity of* JUICE from a given quantity of sugar-canes is, and ought to be, the object; but by the present mode of working the mill, rarely 10 parts of the sacaharine matter out of 18 (which good canes contain) is obtained; and, consequently, if the whole were extracted, *as it can be*, by improved means, then 100 acres of canes would yield a proportionate increase of products to those now obtained by the common method.

The advantages of an ENDURING PRESSURE on the canes when passing between the rollers of the horizontal mill, which rollers are preferable to those placed vertically, as the feeding of the former is uniform, and not so the latter; but even with such uniformity the canes get only a nipping squeeze at the point of convexity between the top and bottom rollers; therefore, in lieu of so milling the canes, it would be a great advantage to subject them to an ENDURING pressure, and not to nip and squeeze them momentarily only, as is now the case. This manifest advantage led me to invent sugar-cane mills of one roller only, and of two, and especially to the improved mode of rotating the periphery of the top roller of the mill, now generally used, at a different velocity to that of the bottom rollers, as, by such dissimilar speed of rotation, the canes, in a longitudinal direction, are subjected to a PRESSING, RUBBING, and CRUSHING POWER, and not merely to a momentarily nipping squeeze.

In order to secure the benefits that might arise from supplying such power for expressing the juice from the sugar-cane, and other improvements hereinafter stated, I obtained a patent in April, 1845, for improved sugar-cane mills, of an entirely new construction, and also for fixing upon the gudgeons or axles of the rollers of sugar mills, such as are in general use, pinions of dissimilar diameters, whereby the advantages described can be obtained. One set of such pinions have been tried in the West Indies, and the engineer's report is, that "the megass or pressed canes were as dry as straw." A set has also been sent to the East Indies, and another set has been recently ordered for a mill about being erected in one of the West

Digitized by Google

India islands; and it is anticipated that these pinions will be generally adopted, as the expense is trifling, and because they can be fitted and fixed to any mill now in use.

It may be remarked, and justly so, that a greater power than that now employed for working a mill with pinions of equal diameter would be necessary, but it would be so only when the rotation of the rollers is as quick as they are usually worked. The motive power employed, whether that of a steam engine, water-wheel, windmill, or cattle, would suffice without addition thereto; because a slower speed would compensate for any extra power that might be necessary for rotating the rollers with pinions of dissimilar diameters, or mills with rollers of dissimilar diameters, and with pinions of similar diameters, would produce the like effect; and the result would be an increased quantity of juice from a given weight of canes, proportionate to the ENDURING PRESSURE of the rollers.

ADCOCK'S SPRAY-PUMP.

Sir,—I have observed for a long period the various reports made in reference to practical trials of Adcock's patent spray pump, in the prosecution of which, I must be much within bounds when I say, above five thousand pounds have been expended, taking the several demonstrations made with it in Liverpool, Wigan, Tipton, and Llanhiddel.

At Wigan, in Lancashire, it was erected, at the pits belonging to Mr. Daglish, a well-known engineer and large coal proprietor. The experiments made there were very numerous, consuming considerable labour, time, and outlay of capital. Great expectations were entertained throughout the neighbourhood for two or three years; abandoned pits were to be recovered by a blast of air and a few zinc pipes, instead of employing pumps and pump-rods, with buckets, clacks, and valves, and heavy pipes of cast iron—(*Mech. Mag.*, September 11, p. 41.) Yet, strange as it may appear, the whole undertaking was abandoned, and the old method of pumping resumed.

We next hear of Mr. Adcock at Tipton, near Birmingham, with a mine, over which the proprietor gives him complete control. There he adopts a large blast cylinder, considering his previous failures entirely attributable to employing the revolving blower. Exhibitions of the working of the spray pump take place; all is pronounced by the inventor to be satisfactory, and yet we shortly after hear that the spray pump is lying prostrate in an adjoining field, awaiting its removal to Wales!

Mr. Adcock is now, and has been many months at Llanhiddel, at the collieries of Reginald Blewitt, Esq., member for Monmouthshire. The exhibitions there have been numerous. At one trial of the patent pump, we learn that Messrs. Harley, Williams, Flevick, Powell, Protheroe, Russell, Latch, and Dowling, with others, were present. There is, therefore, no secrecy (or need be none) about Mr. Adcock's operations; nor can I see that there is any particular occasion to withold from the scientific world every and the fullest information respecting an invention, which is decidedly either one of the very best, or one of the very worst and most deceitful of the present day.

It is in reference to this latest remove of Mr. Adcock that your correspondent "Cassell Morlais" writes in your number for 11th Sept. His letter appears to me to be written in a very fair, honest spirit; so much so, that I never doubted it would elicit from Mr. Adcock an unreserved reply. But how was I disappointed when your magazine for last Saturday came to hand? Till now, I had always supposed Mr. Adcock to be incapable of such flirtation as his letter displays, particularly in a matter of equal consequence to himself and the best interests of an important body like our mine owners. He asks your correspondent for his real name and address only, with the flippant assurance that then—"I may *probably* deem it worth my while to reply to him." His "public exhibitions" of the spray pump at Llanhiddel, he says, are "matters so important, it cannot be supposed that I can find time to reply to every anonymous correspondent who, *assassin-like, stabs in the dark!*" First, no one but Mr. Adcock can trace the *assassin* in Morlais's letter; and, secondly, he might have replied to this first anonymous correspondent so far as to give what he considers the unperverted facts, and then declare his requirement of names to any future correspondence. How much more likely would this sensible and natural course of conduct be to operate in his favour, than his rushing into the arena afforded by your excellent magazine, only to declaim about assassins, stabs, poison, malice, and such mere nonsense, addressed to your readers on the one hand, while on the other, he retires bowing significantly to his Welsh customers, with an assurance that the letter in question is "an insult to the understandings of those scientific and practical men who have seen the operations of the spray pump, and *have given orders.*" It is, assuredly, very ridiculous, not to say contemptible, for Mr. Adcock to write in this querulous strain, when, in fewer words than he has thus fruit-

Digitized by Google

lessly employed, he could have given the best refutation of "wilfully and wickedly perverted facts," by opposing to these a few of his own facts and figures, and which, indeed, he is bound to do; for he may rest assured, until he does this, it will, after six years' experimenting, reasonably appear that there is still some screw loose.

I am, Sir, yours, &c.,

J. PHILLIPS.

Nelson-street, Greenwich,
Sept. 20, 1847.

[We recommend the preceding very sensible letter to Mr. Adcock's serious attention. Reasonable doubts, founded on given data, are not to be disposed of by mere angry words. Nor does it matter anything in such a case by whom the doubts are started—whether by some plain "John Smith," who gives you both his name and address, or some "Tim Shellis," who, delighting in anagram and bush-fighting, leaves you to guess who he is. The game is started anyhow, and it were wiser to run it down as fast as you can, than to insist on first knowing "who started the hare." "Cassell Morlais" may have made mistatements—more probably mistakes; but if he has, there will be more to be gained by refuting than reviling him. ED. M. M.]

THE "CRICKET" STEAM-BOAT EXPLOSION.

The consequences of this explosion, (of which we gave a brief notice on the day of its occurrence,) were fortunately much less disastrous than at first reported. Only five persons appear to have lost their lives; and though no correct return of the wounded has been obtained, there is a prevailing impression that the number has been inconsiderable. A coroner's inquest has been held on the bodies of the persons killed, which, after repeated adjournments, and the production of a large mass of evidence on the subject, is, at the time of our now writing this, assembled to consider their verdict. The only portion of the evidence which seems to us of engineering interest, is that of Mr. Lloyd, the chief engineer and inspector of machinery of the royal navy, who was appointed by government to inquire into the cause of the accident; and that we shall give at length:—

Mr. Lloyd.—I have examined the machinery of the *Cricket* steam-boat. I have had a few drawings made by way of illustration, and I now produce, for the information of the jury, a plan of the vessel when I first saw her after the accident; a plan of the boiler, a drawing of the safety-valve with the weight, a drawing of the spring-balance with its safety-valve, and a drawing of the front of the boilers, as they originally appeared. I also produce some specimens of the *Cricket* boiler, the material of which has been cut into slips and tested. The engines are high-pressure engines, on the principle well-known by the name of Wolff's. There are two cylinders to each engine; one cylinder in which the steam is used at high-pressure, and where, instead of passing into the open air, as it does in an ordinary high-pressure engine, it passes into the second and larger cylinder, from which it passes into the condenser, where it is condensed in the ordinary way. The object of this arrangement is, of course, the saving of steam, and, therefore, of fuel. So far as I saw, the materials and workmanship of the engines were good. As compared with high-pressure engines of the ordinary construction, I should say there is nothing objectionable in the principle of these engines in point of danger. There were attached to the engine two pumps for feeding the boilers, another pump, worked by an auxiliary engine, which is commonly called "the donkey," and a fourth pump, to be worked by hand, for feeding the boilers also. These pumps appear to be all that is necessary. With regard to the boilers there were two, consisting of an external cylinder, 5 feet in diameter, having an hemispherical end at the back, and a front composed of a flat plate. To this flat plate are fixed a cylinder forming the furnaces, and all the small tubes through which the products of combustion pass. The internal part of the boiler, consisting of the furnace, the firebox, and the small tubes, was secured to the shell by the riveting round the circumference of the front plate, and by two stays, one fixed between the end of the firebox, and the end of the boiler, and the other stay fixed obliquely between the top of the front and the upper part of the shell. There was a steam dome also rivetted to the top of each boiler, and on each dome there were two safety valves pressed down by levers: one lever having a weight at its end, and the other being a spring-balance—Salter's balance. The thickness of the tube-plate was three-quarters of an inch; of the front plates—that is, the plates on the top and bottom of the tube-plate, three-eighths of an inch, and of the shell three-eighths of an inch. I ought to have said that the front of the boiler consisted of three plates; the centre one (the tube-plate) was three-quarters of an inch thick, and the top and bottom plates, or shell, were three-eighths of an inch thick. The dome-plate is five-sixteenths of an inch in thickness. The angle iron round the front of the boiler was three inches by half an inch. All the other angle iron is two and a half inches by three-eighths of an inch. The rivets in the boilers are three quarters of an inch in diameter, and those in the steam-dome rather smaller. All the rivets of any importance are three-quarters of an inch in diameter. Assuming each boiler to be of 16-horse power, the total heating surface in the boiler is 14 eight-tenths square feet per horse power. The area of the fire-grate is 56-100ths of a foot per horse power. There was nothing objectionable in these proportions, in the amount of area of fire-grate and heating surface. The quantity of water in the boiler up to the middle gauge-cock, is about 3 8-10ths of a cubic foot per horse power, and the steam-room about 1½ foot per horse power. I have calculated the pressure upon the safety-valves, supposing the weight to be at the extremity of the lever, at very nearly 66lb. to the square inch. Taking the spring-balance as it was when I saw it, the pressure per square inch, when the valve was just about to open, would be 40lb. per square inch; but, if the valves were wide open, the spring-balance would produce a pressure of about 170lb. per square inch. The valves are both lever valves; but one is pulled down by the spring-balance, and the other is pulled down by the weight. As the lever rises, the pressure is gradually increased upon the spring-valve. I may mention that 1lb. on the spring-balance produces a pressure on the valve of nearly 2lb. The weight and spring valves operate jointly on the boiler, but separately as regards each other. I apprehend that if all these valves had been properly in operation, the steam could not have accumulated in the boiler to any dangerous extent. I do not approve of the arrangement of this spring-balance valve. I think it objectionable, be-

Digitized by Google

cause, when the valve has been raised such a distance as to relieve the boiler materially, the pressure brought upon it is very much increased, the power of the lever being nearly as 10 to 1. This is not the usual way in which spring balances are used, as far as I know. I cannot say the spring valves would be liable to be easily disordered. I think it is wrong in principle to put a spring balance at the end of a long lever, because the pressure is increased very considerably as it is raised from its seat. I object altogether to valves being in the power of the engineer, to load as he pleases, especially in the case of high-pressure engines. As to the weight valves, I think, if it were not intended to work these boilers at the pressure of 66lb. to the square inch, such a weight as was on the levers ought not to have been put upon them. The same remark applies to the spring balance, because it can be screwed down to any pressure the engineer might think fit. From the spring valve being on the boiler, I should draw the inference that it was intended the engineer should use it if he thought fit. With regard to the construction of the boiler, I may say, that in my opinion, it is dangerous to be used as a high-pressure boiler. The whole of the pressure of the steam within the boiler is brought either directly or indirectly upon the flat plate in the front. I find, when the pressure of steam is 66lb. upon the square inch, the direct pressure upon this plate is 83 tons. This pressure is withstood entirely by the stiffness of the plate itself, with the small addition of the two stays I have before mentioned. I do not believe that a pressure of 66lb. on the square inch would have burst this boiler at present; but I think, when the boiler was somewhat older, it might have done. I may mention, perhaps, the objections which naturally lie against a flat plate of this kind. In the first place, you cannot calculate what pressure it ought to bear; and the pressure upon the inside of it tends to produce three different effects. There is a strain brought upon it at right angles to the surface, and if the plate was perfectly rigid there would be no other effect; but, the plate not being rigid, an enormous pressure is brought upon it in its own plane. This second action may may be illustrated by considering the pressure brought upon a musical string by pressing it sideways. There is a third action upon the plate produced by the bending of the plate, the outer circumference of the plate remaining nearly in the same plane, and the inner part being considerably bulged. I have come to the conclusion, from the best examination I can give to the subject, that the strength of this front plate, aided by the two very imperfect stays that were put in the boiler, was not sufficient to bear for a length of time,—that is, during the usual time a boiler may be supposed to last,—a pressure of steam of 60lb. upon the square inch. At the present time, unquestionably, it would bear that pressure. Supposing all the valves were prevented from acting, and the pressure was 60lb., I calculate that in five minutes the pressure would increase to 90lb.; in ten minutes it would be from 130lb. to 140lb.; and in a quarter of an hour it would rise to about 180lb. I cannot conceive it probable that all the four valves would stick at the same time. I do not think, if one valve was at liberty, that it would relieve the boiler of steam as fast as it was generated, supposing the other three valves were fast. If two valves were at liberty, they ought to relieve the boiler sufficiently. I may observe, that the area of the steam valve is nearly five square inches, but the area of the waste steam-pipe, which takes the steam into the funnel, is only two seven-tenths square inches. I think, if the two weight valves were tied, and the two spring valves were free, a dangerous pressure would be produced upon the boiler. After having made an examination of the boiler, I thought it was proper to test the goodness of the materials, and I took pieces of the plates of the boiler which were rent when it burst. These plates are three-eighths of an inch thick. I cut strips of two inches in width from them, both with and against the grain, and tore them asunder by a machine for that purpose at Woolwich. I now produce four strips of the boiler-plate. In order to make a comparison as to their goodness, I had four slips cut from a new plate of the same thickness, and subjected to similar tests. The average strength, the tensile strength, per square inch of the plates of the *Cricket* boiler was 17 tons; and the strength of the best kind of plate of the same thickness which I tried at the same time was 21 2-3 tons. The new plates I tried were Low Moor plates. They are of very far superior quality to the plates of the *Cricket*. The plates of the *Cricket* boiler are laminated. I attribute that to bad quality. It will happen, undoubtedly, in plates of the best quality, but it is a thing very much to be avoided. When I say the iron of which the *Cricket* boilers were made was bad iron, I should rather say that it was bad iron, considering the purpose to which it was applied—to a high pressure engine, and considering also where it was applied—to the front of the boiler, where it was most likely to break. I tried some common Staffordshire plate at Woolwich, which was nearly equal in strength to that of the *Cricket;* it bore 16 2-3 tons upon an average, which was low. I do not consider the workmanship of the boiler to be such as it ought to have been for a boiler of this kind. The rivets, generally, did not fill the holes, and they were generally not sufficiently long to make a good rivet. The boiler does not appear to be seriously deteriorated by wear, except at the lower part. I should not attribute the explosion to the wear of the boiler. The part which exploded was in the front; the whole of the front was torn off. The boiler was, of course, weaker than when it was new, but not materially. There is no calculation by which we can tell what pressure the front plate ought to have borne. I applied tests to ascertain the quality of the iron, and I come to the conclusion that the iron was not of very good quality, considering the purpose to which it was applied. Such iron is used in the royal navy commonly for those parts of the boiler upon which there is no great strain. Where the plate was thinnest, there the plate tore; and where it was thicker, the part to which it was fastened gave way. With the consent of Mr. Smith and Mr. Joyce, who afforded me every facility during the inquiry, I made an experiment on the unexploded boiler. I brought upon it a pressure of water of 136lb. per square inch before it exploded. The boiler we tried was sensibly injured by the explosion; the plates of both were of the same thickness. Both the stays of the unexploded boiler were separated, and a part of the angle iron which secures the front to the shell of the boiler was cracked. Upon this boiler I brought a pressure of water of 136lb. per square inch, and then the boiler leaked to so great an extent, that a greater pressure could not be obtained. My opinion is, that the pressure of steam which caused the explosion could not have been less than 136lb. upon the square inch. That, of course, is matter of opinion; but I have come to that conclusion. I think the other boiler could not have exploded at a less pressure than that—but it is a mere guess. You can calculate perfectly what the shell of the boiler ought to bear. I have no reason to suppose from the examination I made that there was any deficiency of water in the boiler. I do not think there is any reason to suppose that. The boiler is called tubular, from the circumstance of a number of tubes being introduced, to absorb the heat. We regard the tubular boilers as safe boilers. I think they are safe, if properly made. The tubes of the exploded boiler were perfectly good. The great objection I have to the boiler is—firstly, the form of the flat front of the boiler without proper staying; and, secondly, in a far less degree, the quality of the material and the workmanship.

The Coroner.—Can you form an opinion as to the cause of the explosion?

Witness.—There can be no doubt of the cause of

Digitized by Google

the explosion, namely, the improper increase in the pressure of the steam shortly before and at the time of the explosion. If the steam gradually increased its pressure from 60 lb. to 130 lb. or 150 lb. in the space of 10 minutes, or in any other time, that would probably be sufficient to cause an explosion. That the unexploded boiler had evidently never been subjected to a similar pressure as at the time of the explosion, is apparent from the fact of its leaking very considerably at the pressure to which it had been subjected on the day of the explosion. There is a connexion between the water part of the boiler and the steam part of the boiler. The pressure would be the same on both boilers at the same time, that is, if only one valve had been in operation. In order to show the great pressure upon the unexploded boiler, I may state that the flat plate on the front of the boiler was permanently bulged to the extent of 1¾ inches before I made my experiments. After it had been subjected to the water pressure of 136 lb., the bulging was 2 1-16 inches; the lower front plate of the boiler then began to break exactly like the one which was broken in the exploded boiler. If all four of the valves had been at liberty, it was impossible for the steam to have caused the explosion. If both the spring valves had been at liberty, the explosion could hardly have taken place; at all events, the time would have been postponed, perhaps 10 minutes. I have every reason to believe that the valves must have been closed, either by accident or design, at the time of the explosion, or else open to a very small extent. The stays were no doubt the first to go when the plate began to bulge. The inside of the boiler struck against the engines, which stopped its further progress; that saved all the people in the front of the vessel. The shell of the boiler went through the after part of the vessel, and went out at the stern. When you consider that the pressure upon the boiler might have been 180 tons, and assuming the shell to have weighed a ton and a half, you get a force of more than 100 times the force of gravity, which accounts for the velocity given to a mass of iron in such a wonderfully short space of time. I did not see the balance valves of the exploded boiler. The balance of the unexploded boiler was correct.

By Mr. Chambers.—The object of the spring to the valve is not to prevent its opening too widely, that ever I heard of, but merely as a substitute for the weight in a more convenient form. I do not disapprove of spring valves, but only of the manner, and place in which they were used. I object to their being used in such a way that, as in the case before us, 1lb. on the lever would produce a pressure of 2lb. upon the boiler. Mr. Salter's spring balances are very excellent things. I object to the engineer having the control over the valves at all. You can always raise a valve in a well-constructed boiler, but not pull it down. The engineers in the Royal Navy have not access to the valves: in locomotives the engineers have access to the safety valves. I found the spring of the unexploded boiler correct; as nearly as can be calculated, it was about 40lb. per square inch when the valve was shut, but as the valve opened the pressure increased. For anything I can tell, the safety valve was not permitted to rise in the unexploded boiler. If both the Salter's balance valves had been in a fit state, a longer time would have been necessary to get up the steam to the bursting pressure. I cannot tell whether they would have opened sufficiently to let out the steam of themselves; I doubt very much whether they would. The waste pipe of the *Cricket* is small, and is a bent pipe, and all that impedes the passage of the steam into the chimney, but to what extent it is impossible to say. The noise would have been very great if any of the valves had been acting, and the steam had been 5lb. above 40 degrees. Every one who was near the funnel must have heard the steam going out of the funnel. I should have preferred two more weighted valves to these spring balance ones, certainly. The mercury gauge is the guide to the engineer as to the pressure of steam; it is liable to get out of order if either water or air gets in. There are no other guides to the engineer, except the guage and the safety valves. The pressure upon the front plate of the unexploded boiler was a gradual pressure; it began to give at 120lb. and then leaked a great deal. I do not see how the pressure of steam could be brought to bear so suddenly as to give any force of "impact." There were two stays to the unexploded boiler; both had been separated. Either sudden or gradual pressure would have accounted for that separation. The stays themselves were strong enough; it was the fastenings that had given way. If the valves were closed at 60°, the pressure would in five minutes have got up to 90°. I did not make the experiment; I should have been sorry to do so. I know the quantity of water which a boiler of that kind will convert into steam; I know how much heat there is in that steam; and then I see, by experiments made by other persons, what elasticity is due to that increased temperature. I assume that the fires were burning briskly, and every means used for forming steam as powerfully as possible. If the tubes were out of order, or there was any leakage, the creation of steam would not be much affected. The tubes ought to be so heated as to assist in the heating of the water; and if they were clogged up, steam would not be formed so rapidly as would otherwise be the case. If the pressure had risen as high as 180 in the exploded boiler, the steam would have made a great noise if the valve had been open. If the stoker or engineer had been there under such circumstances, he ought to have drawn the fires. I know very few engineers who understand these matters thoroughly. (A laugh.) I wish we could get people who did understand them; but no man is allowed to drive an engine in the Royal Navy who has not undergone such an examination as may from time to time be considered necessary. I think that you ought to get the best men that can be got as engineers, and the only course to pursue is to increase the wages, if any difficulty arises in obtaining qualified men.

By Mr. James.—My opinion is, that if all the valves of the *Cricket* had been in operation at the time of the accident, the explosion would not have occurred. That opinion is fortified by the evidence I have heard. It is fortified by the statement of some of the witnesses that, when the boat was lying at the piers, no steam blew off, supposing that the steam pressure was as high as has been represented. If the steam gauge had been at 40, and the valves had then been tied down, the pressure of steam must have been considerably increased. I think a pressure of 66lb. on the square inch, would not, at the time of the explosion, have burst the boiler of the *Cricket*. 66lb. was the maximum pressure that could be brought upon the boiler, if the weight had been placed at the extreme end of the lever, and all the valves were in operation. The pressure could be reduced by moving the weight towards the fulcrum. The engineer might screw or fix the spring valves down to any particular pressure. I should think a man who tied down the weight valves would not be very careful in the use of Salter's balance. High-pressure engines are used invariably for locomotives; they have Salter's spring-balances. In the dockyards some high-pressure engines are used for particular purposes. I should prefer low-pressure engines, if they were suitable for those purposes. I should say the boiler that exploded must have been weaker than the one that remains, because the pressure would be alike upon both. The boiler that I tested did not stand a very severe test for a high pressure boiler. We tried it without the ordinary stays; and it was then bulged in consequence of a previous strain. The maker of a boiler ought to allow for any weakness that may be caused by corrosion. I have been told the boilers were proved before they were put in the *Cricket*. Mr. Joyce, and everybody connected with the vessel, afforded me every facility. Low Moor iron is some of the best iron that can be got. It is not used much for

Digitized by Google

the boilers of commercial steamers; but it ought to be used for high pressure boilers. I think the pressure of steam a boiler ought to be worked at should not exceed one-tenth of its calculated strength, supposing it to be made of the very best materials and workmanship. The locomotive engines work at from 80 to 100, probably. I never tested the exact strength of the boilers of locomotives; but they are constructed in the best manner. Low Moor iron, or iron as good, ought always to be used for certain parts of boilers. The highest pressure borne by one of the pieces of Low Moor iron I tested, was 22 tons and two-thirds. I have made high-pressure boilers, for the government, of Low Moor iron; but I don't know whether the boilers of commercial steam-boats are made of that iron. Almost all tubular boilers have flat plates in front. If I used a flat plate, I should construct it in such a manner that the stays themselves might sustain the entire pressure. If the valves were tied down and the boiler was subjected to a strain of considerably above 66 lb., the effect would be gradually to weaken the boiler. All the parts of the boiler made to resist the straining would be acted upon by such a constant pressure. Assuming the fact that this boiler had been strained in the manner represented, some allowance ought to be made for it in favour of the manufacturer. The dome would not be affected by the pressure of 136 lb., which I applied to the unexploded boiler. The vulnerable part of the boiler is the bad plate in front. I would not undertake, at any price, to make a boiler to be worked with closed safety valves. I would not undertake to work an engine with the valves tied down. (A laugh.) Would as soon do one thing as the other. There is one stay at the back of the boiler, and another in front, inside. The pressure which burst the boiler would be pressing upon the whole area of the boiler. The pressure on the front of the boiler may be supposed to be borne by the two stays, and, if the stays were removed, the front would immediately go. Supposing an engineer periodically to have tied down the valves, it is impossible to say to what pressure the boilers may have been subjected. The greater the pressure, the more the boilers would be weakened. The steam gauge, from the description given of it by the witnesses, was a proper one, and ought to have indicated the full pressure of steam. When I saw the levers of the *Cricket* there was no cord round them. I should think at the time of the explosion there must have been a pressure of from 130 to 140 upon the boiler. My reason for coming to this conclusion is, because the other boiler was disabled at this pressure.

By Mr. M'Intyre.—I think if all the valves had been open the accident would not have occurred. If one of the lever valves had been free, I don't think the explosion would have taken place. It was not necessary to have a flat front to the boiler. I should have preferred a convex plate. The valves of the river boats, in which dirty water is used, would be liable to be clogged; but I do not think they would stick so far as to produce any dangerous pressure. It is possible that, without any design, two of the four valves might have stuck at the time of the explosion, but it is very improbable that they would have been so much clogged as to resist any considerable increase of steam pressure.

By the Jury.—The difference in the value of the Low Moor iron for the front plate and that which was used for the front plate, would not have been more than £2 or £3. The front plates were the plates subjected to the greatest pressure of the steam. The Salter's valve does not, when raised, produce a greater pressure upon the boiler, but only indicates a greater pressure. The escape of steam into the engine-room does not necessarily indicate that the valves were tied; it might have been produced by the condensers becoming too hot. If the condensers had more work than they could do, the steam would have come into the engine-room.

Mr. M. Chambers.—Are not the boilers of the *Ant* and the *Bee* ten times the working strength?

Mr. Lloyd.—I cannot say; but if the fronts of those boilers are not stayed better than these, they are dangerous boilers.

Mr. M. Chambers.—I am told they are.

Mr. James.—These boilers are not ten times the calculated strength. We say, we hope they will work safely, if the valves are not tied down.

The evidence of a number of the other witnesses examined having gone to charge Clark, the engineer of the *Cricket*, with being in the habit of tying down the valves of the engine, Clark of his own accord presented himself before the inquest to be examined. His object, it is to be presumed, was to rebut that charge; with what success, let the following extracts from his evidence attest:

By Mr. James.—I never tied any of the cord that was to keep the valve in action. I never saw Knight tie the valve. I have put a fresh bit of cord on about once in three weeks. It was a sort of spun-yarn; it used to wear out with so much pulling. (A laugh.) It used to wear out close to the weight from the constant pulling. It was a three-yarn spun and a five-yarn spun-yarn. I have wound it round the nail, but it never fastened the valve down.

Mr. James—You are upon your oath, and I ask you whether you *have not given directions to Knight to tie down those strings?* Stand forward, Knight.

Witness.—*I can't say but what I have.*

Mr. James.—Frequently?

Witness.—Not frequently, *but generally after the boat has started.*

Mr. James.—Do you swear that you have never given him directions to fasten the string whenever the captain has given the word to "Stand by?"

Witness.—I don't think I have.

Mr. James.—Will you swear you have not?

Witness (after a pause).—Yes, I will. The rope wore out once in about three weeks; it was chiefly by the arm of the lever that it was tied. I used to pull it three or four times while lying at the pier, to be sure the valve was working. Sometimes the steam blew off at 25 degrees. The steam generally blew off when we were lying off the pier; the valves were generally lifted. When the orders were given to "Stand by," we used to lift the valves. * * * I do not think it would take six inches of the rope to allow the valve to have free action. I think it would act in one inch.

Mr. James.—I ask you, in the presence of Mr. Lloyd, and other scientific gentlemen, whether it would not take six inches?

Witness.—I will not swear it would not. It sometimes had more; sometimes it was not fast at all, and sometimes it had less. I have never seen Knight fasten down the valve so that it could not act. I have almost always tried it after him. I told him to look at the valve and fasten it. I do not believe I have ever seen Edwards fasten down the valve without giving the valve room to work. I will swear that Edwards never fastened it without giving it two inches to act in. I should think that half an inch was enough.

By the Jury.—I took the cords off the levers every night. I think the valves of high-pressure engines are more liable to stick than others. Either Edwards or Buttriss might have tied the valves out of spite to me, *and I believe they did do so.* The steam was blowing off pretty strong on the morning of the explosion about eight o'clock. The steam would blow off like thunder if the valves were up an inch. The rope must have been slackened 18 inches to raise the valve an inch. I don't recollect the valve ever lifting more than an eighth of an inch.

By Mr. Chambers.—I never fastened the cord attached to the lever in any other way than by twisting it round a nail.

Digitized by Google

LIST OF ENGLISH PATENTS GRANTED FROM SEPT. 23, TO SEPT. 24, 1847.

John Dickenson, of 65, Old Bailey, stationer, for certain improvements in the manufacture of paper. September 23; six months.

Henry Newton, of Litton-hill, near Bakewell, Derby, cotton-spinner, for improvements in spinning and doubling cotton, and other fibrous substances. September 23; six months.

George Bell, Dublin, merchant, for improvements in gas tar, by means of which improvements it may be used as a substitute for oil, paint, and which he intends to designate "Patent Mineral Paint." September 23; six months.

Arthur Harry Johnson, of Gresham-street, London, assayer, for improvements in refining silver lead, by effecting a saving in one of the materials used. September 23; six months.

Charles Hancock, of Brompton, Middlesex, gent., for improvements in the preparation of gutta percha, and in the application thereof alone, and in combination with other materials, to various manufacturing purposes. September 24; six months.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Sep. 16	1198	George Chambers	Studley, Warwickshire	Needle gauge.
17	1199	Phillip Warbleton	Upper Hallam, near Sheffield	Razor blade.
,,	1200	Deane John Hoare	Greenwich	Railway telegraph and alarm.
,,	1201	James Lewis	Stamford-hill, horticultural builder	Improved Polmaise stove.
18	1202	William Wilton	King-street, Manchester	Hot water cistern for baths.
20	1203	Dawbarn and Son	Bold-street, Liverpool	Back piece of a frock or dress coat.
22	1204	John Simmons	Birmingham	Hydraulic jack.
23	1205	George Paul & Henry Fletcher	New Bond-street, Military tailors	The "Palla Gallica," or long-sided coat.

Advertisements.

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs T. Burnell and Co., 1, Great Winchester-street, London.

Adcock's Patent Spray Pump.

THIS important Invention having been Perfected, and brought into Successful Practical Operation at LLANHIDDEL, at pits belonging to R. J. Blewitt, Esq., M.P., Llantarnam Abbey, near Newport, Monmouthshire, the PATENTEE is ready to Receive and to Execute, Orders. Apply to Henry Adcock, C.E., at his Offices, 137, Strand, London, where pamphlets, descriptive of the invention, may be had: at the Office of the *Mining Journal*, 26, Fleet-street; and through any respectable Bookseller. Price 6d.

System of Pure Mathematics.

On the 1st of October, in one large vol. 4to, of 1,090 pages, with 17 plates, price 31s. 6d., cloth lettered,

THE ENCYCLOPÆDIA of PURE MATHEMATICS. By Professor G. B. AIRY, Astronomer Royal; P. BARLOW, F.R.S., Woolwich; A DE MORGAN, F.R.S., University College; Rev. T. G. HALL, M.A., King's College; Rev. H. P. HAMILTON, F.R.S.; D. LARDNER, L.L.D., F.R.S.; A. LEVY, F.G.S., Liege; Rev. H. MOSELEY, M.A., F.R.S., King's College; and the Rev. Dr. PEACOCK, Dean of Ely.

Being the Second Volume of a Methodical Re-Issue of the *Encyclopædia Metropolitana*, in separate complete Encyclopædias, published monthly.

"Without wishing to offer any undue eulogium on these Treatises, we may confidently ask that portion of the public, which is qualified to judge of their merits, to compare the WHOLE SYSTEM OF PURE MATHEMATICS here presented to them with that in any similar work, whether of this country or of the Continent, on the grounds of *arrangement*, *clearness*, *ability*, and *completeness*. From any ordeal of this sort, however severe, this Encyclopædia will not shrink; and it is confidently believed that no parties connected with it would have reason to regret the comparison."—Rev. H. J. Rose, B. D. *Editor*.

JOHN J. GRIFFIN and CO., Chemical Museum, 53, Baker-street Portman-square, London; and R. GRIFFIN and CO., Glasgow; of whom may be had,

1. The ENCYCLOPÆDIA METROPOLITANA, complete, bound in 30 volumes, price 20 Guineas cloth lettered, and 25 Guineas in Half Russia. Originally published at 59 Guineas in Parts.
2. The ENCYCLOPÆDIA of MENTAL PHILOSOPHY. 4to., 21*s.*
3. The ENCYCLOPÆDIA of the MEDICAL SCIENCES. 4to., 21*s.* (on Nov. 1st.)

(*Prospectuses may be had gratis.*)

Digitized by Google

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings, and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Patent Bells.

MESSRS. MEARS beg to call the attention of the Trade and the Public generally to these articles, which they are now prepared to supply in any quantity and variety. The composition is of a new metal, called the Union Metal, and the bells are of very beautiful tone, and cheaper than those made of the ordinary bell metal. Orders received at the Bell Foundry, Whitechapel, for house, cattle, and other bells.

Cunningham & Carter's Pneumatic Railway System.

Description.

THE SYSTEM OF PROPULSION, now submitted to the notice of the Public, differs essentially from all the plans hitherto tried or proposed, and is considered to be WHOLLY FREE from the PRACTICAL DIFFICULTIES which have so seriously retarded the application of atmospheric power.

The carriages run upon lines of rails, constructed and laid down as usual, but their propulsion is effected through the medium of rails, attached to the sides of the carriages, which derive their motive force from being brought into contact with the peripheries of a succession of revolving horizontal wheels, placed in sets of three each, at distances of about 300 feet apart—one wheel being placed outside of each line, and the third in the space between the two lines—all three being connected and put simultaneously in action by air-engines, suitably mounted; these communicate with an atmospheric main, common to the whole series of engines, laid down outside the rails, beneath the surface of the ground.

The shafts of the three horizontal wheels revolve in proper bearings, within an iron case, fixed in a trench beneath the rails, and extending transversely into the banks. The case being made in sections, can be laid down with great facility: it protects the inclosed machinery from injury, from wet or dust, or interference—while access may be readily had to the interior, for the purposes of inspection or repair.

The propelling wheels are themselves all above the ground.

Among the numerous ADVANTAGES arising from this arrangement, the following may be stated:

The PROPELLING WHEELS being above the rails, no alteration will be required in the rails or carriages, as now constructed.

The PRIME MOVERS, or STATIONARY ENGINES, may be situated wherever fuel is cheap, or water power exists; and, as they all work into the main tube, no delay to the traffic can occur through the derangement of either of them.

POWER being always in readiness, TRAINS may follow each other in rapid succession—while their starting may be so regulated, independent of the drivers or guards, that it shall be impossible for one train to overtake, or come in collision with, another.

As the number of revolutions of the propelling wheels, and the degree of adhesion of the same, may both, or either of them, be increased or diminished at pleasure, independently of the prime movers, an engine, or engines, will be capable of a greater range than at present.

By this system any kind of work can be performed, as the engines work equally well each way.

No unpleasant effects from gas, steam, or cinders.

Perfect safety secured, by fixed and self-acting arrangements, out of the reach of interference, and entirely independent of attendants.

Great economy in the formation of new lines, from reduced weight of rails and general cost of works, where no locomotive engine is used.

Great economy in the working expenses, arising from the use of stationary power, and the small amount of deterioration of the works generally.

DAILY EXPENSE OF WORKING A DOUBLE LINE.

Of FIFTY MILES long, during a period of 10 hours, with trains starting from each terminus every half hour.

Six Trains always Running.

Coals for five stationary engines, of a 100-horse power each, at 5 lbs. per horse-power—say, 11 tons, at 14*s.* per ton.....		£7 14	0
Wages—			
Engine-men, with relief, 10 at 6*s.*	£3 0 0		
Stokers, with relief, 10 at 4*s.*.....	2 0 0		
Cleaners, with relief, 10 at 2*s.* 6*d.*	1 5 0		
Drivers, with relief, 12 at 5*s.*...	3 0 0		
Guards, with relief, 12 at 5*s.*...	3 0 0		
Twenty men, stationed along the line, at 3*s.*.....	3 0 0		
		15 5	0
Repairs of engines, with depreciation, &c., at £200 each per annum, multiplied by 5 = £1,000—daily proportion.....		3 15	0
Contingencies.....		4 0	0
Total.....		£30 0	0

Forty trains, at 15*s.* per train, £30, being a fraction more than 3¾*d.* per train per mile.

Parties desirous of viewing the model, or receiving further information, will be immediately attended to, by addressing Mr. Cunningham, at the Auction Mart Coffee-house, Bartholomew-lane, London; or Mr. Carter, Engineer, Peak-hill, Sydenham.

Viaducts and other Railway Work.

THE attention of Railway Engineers, Architects, and Contractors is particularly directed to the great advantages to be derived from the application of SEYSSEL ASPHALTE, as the *only impervious and permanent* covering for arches and roofs, and lining of reservoirs, gutters, &c. The arrangements of CLARIDGE'S PATENT ASPHALTE COMPANY enable it to execute works of any extent with the greatest promptitude.

In order to guard against the use of spurious materials, it is important that all applications for works to be executed be made direct to this Company; and, as a further protection, it is suggested that Engineers, Architects, and Contractors should require a CERTIFICATE from the Company that the proper description of material has been used.

Information may be obtained as to all works which have been executed by the Company since its establishment in 1838, which will prove that the failure of many works represented to have been done with the genuine material has resulted from the substitution of a spurious one.

I. FARRELL, Secretary,

Seyssel Asphalte Company, Stangate, London.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

London, May 17, 1847.

Spence on the Specification of a Patent.

This day is published, in 8vo., price 7*s.* 6*d.*, boards,

A TREATISE on the Principles relating to the Specification of a Patent for Invention; showing the standard by which the sufficiency of that instrument is to be tried.

By William Spence, Assoc. Inst. C. E., Patent Agent.

London: Stevens and Norton, 26, Bell-yard, Lincoln's-Inn, and 194, Fleet-street.

CONTENTS OF THIS NUMBER.

Description of Mr. Baddeley's Everybody's Fire-engine and Universal Force-pump—(*with engravings*) 299

On Balances. By Franklin Peale, Chief Coiner of the Mint of the United States—(*with engravings*) 301

Horæ Algebraicæ. By James Cockle, Esq., M.A., Barrister-at-Law. IV. Classification and Nomenclature—Impossible Equations—Symbols 305

Mr. Craddock's Steam-engine Improvements—the Compressed-Air System 308

The Expression for Acceleration (p. 231) Simplified. By Thomas Wilkinson, Esq. 309

Railway System of Signals. By Owen Rowland, Esq.—(*with engravings*) 310

On the Mill-Grinding and Hydraulic Pressure Processes of Extracting Sugar from the Canes. By Henry Crosley, Esq., C.E. 311

Adcock's Spray-pump 313

The "Cricket" Steam-boat Explosion 316

Weekly List of New English Patents 319

Weekly List of Articles of Utility Registered ... 320

Advertisements 320

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 165, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,

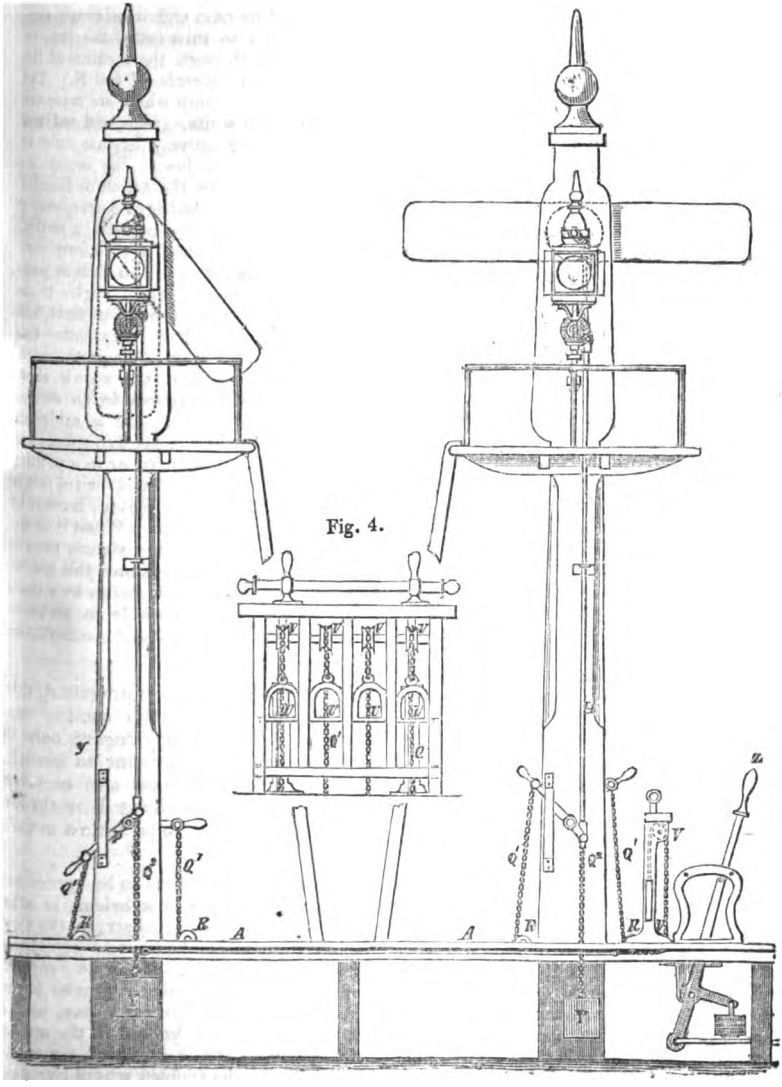
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1260.] SATURDAY, OCTOBER 2. [Price 3d.

Edited by J. C. Robertson, 166 Fleet-street.

STEVENS'S PATENT RAILWAY SIGNALS.

Fig. 2. Fig. 3.



Digitized by Google

STEVENS'S PATENT RAILWAY SIGNALS.

[Patent dated March 10, 1847. Specification enrolled September 10, 1847. Patentee, Mr. James Stevens, of the Da ington Works, Southwark-bridge.]

THE distinguishing features of this invention are, that it combines, in one apparatus or system of arrangements, the instrumentality of arms (such as those employed in the ordinary semaphore), and that of variously-coloured lamps; and combines them in such manner that both may be worked simultaneously, (or nearly so,) and by one attendant, and may serve as well by night as by day, and serve also for two lines of rails at the same time,—say an up and a down line; and farther, that in some cases the apparatus is so connected with the switches employed to turn carriages, and trains of carriages, from one line of rails to another, that the person working the signals can also work simultaneously the switches.

An apparatus, embracing so much of these improvements as are adapted to the use of a station-signal, on a single line of two railways, is represented in fig. 1.

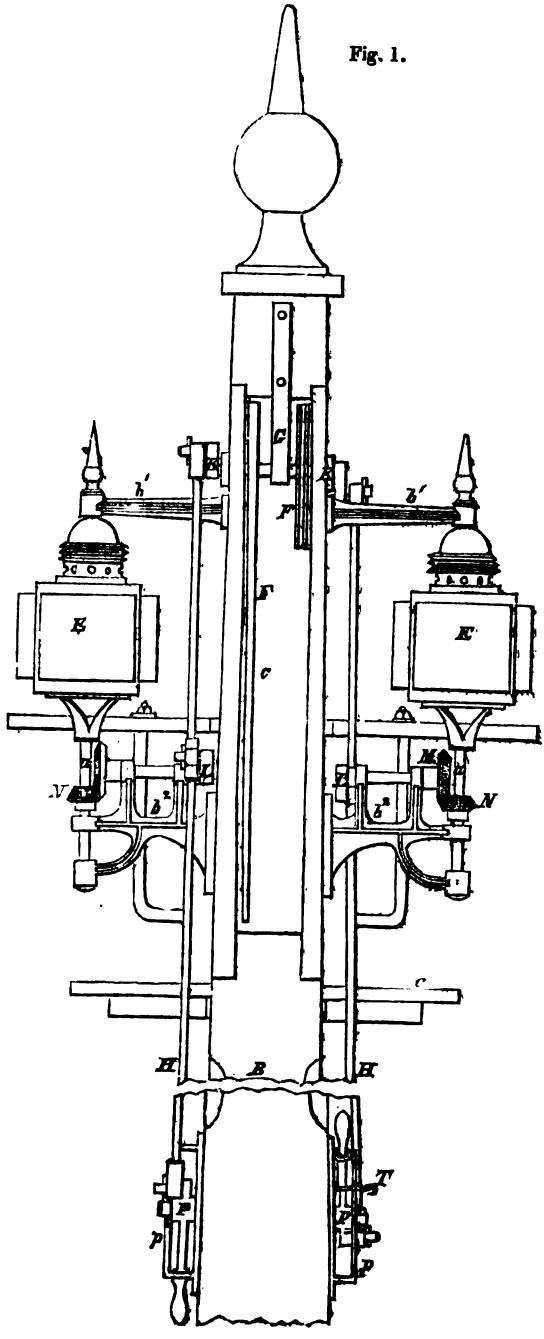
B is the signal-post which is sunk in the ground; C is a gallery to which access is obtained by the ladder; D E is a lamp of four faces, three only of which, however, are made use of, which is attached to and turns freely on a spindle *a*, which is upheld at top and bottom by two brackets b^1, b^2, projecting from the signal-post. (On the other side of the post there is a lamp of precisely the same description, and fixed in the same way.) F F are two semaphore arms, and *c* a recess in the upper part of the signal-post, into which they fall when out of sight. These arms turn on separate axes, so that they may work independently of one another, each axis having its inner bearing in a crutch G, screwed to the top of the recess and its outer bearing, in one of the sides of the recess; H is a rod passed down through the gallery, by which the lamp seen in the figure, and the arm to the left of it, are moved simultaneously (there being a similar rod to work the lamp on the other side of the post, and the arm to its left.) At top this rod is attached to a crank-lever K, fixed on the end of the axis of one of the semaphore arms, and lower down to a second crank lever L, fixed on the end of a horizontal spindle, which is supported from the bracket b^2, and carries at its outer extremity a bevil-wheel M, which works into another bevil-wheel N, on the lamp-spindle *a*. At bottom, the rod H is connected to the short arm of a hand-lever P, which is centred on a bearing attached to the signal-post; and the like is the case with the companion-rod on the other side of the post; so that one attendant may, without shifting his position, work both rods at the same time. Supposing, therefore, either of the rods (H) to be pulled down, its first effect is to raise the arm attached to it, (through the medium of the lever K), and its next and immediately succeeding effect is to turn round the lamp to the left of it, (through the medium of the lever L, and bevil-wheels M and N.) The three faces of the lamp which are made use of, are coloured white, green, and red, and are exhibited successively in that order as the rod H is drawn down: the semaphore arms assume, also, by the action or inaction of the rod H, three positions corresponding with the three colours—namely, a vertical position, (in which they are entirely concealed within the recess *c*,) an oblique position, and a position at right angles to the post. When the arms are out of sight, and the white face of the lamp is exhibited to a coming carriage or train, that is to be regarded as a signal that the way is clear. When the arms are shown in an oblique position, and the green face is exhibited, that is a signal to halt or slacken speed; and when the arms are outright, or in a position at right angles to the post, and the red face is exhibited, that is a signal to stop, because of some apprehended danger. When it is desired to leave for a time the signals fixed in either of the two last positions, this is done by passing a pin T, which hangs by a chain from the post, through a hole in the guide *p*, under the lever P, and into a corresponding hole in the post.

It is of course to be understood, that the conductor of each coming carriage or train, shall pay regard only to the signal-arms which point to his left, as is now the established and universal practice. When the lever P is thrown free, both arms and lamps return to their original positions.

Where a station happens to be approached by a curve, or there is a bridge or other object close at hand to obstruct the view, then, instead of employing one signal-post for both lines of rail, it may be proper to employ two posts placed at a greater or less distance apart, one for each line, and in that case they may be worked in the manner before described, or in either of the modes next directed to be adopted where two posts are made use of.

Digitized by Google

Fig. 1.



Digitized by Google

An apparatus constructed on the same principle as the preceding, but adapted to the case of a junction, where one railway runs into another, each of two lines of rails, and adapted to the working also of the switches at the points of junction, is represented in figs. 2 and 3. In this case, the platform (A) is supported on standards sunk in the ground, but to such a depth only as to leave a hollow space below it to allow of room for certain parts of the machinery which are concealed from view. Two signal-posts, No. 1 and No. 2, are employed, one for each line, and each carrying on opposite faces two arms and lamps, one set for each line of rails. Each arm has, however, in this case, but two positions: one straight out, which is a signal "to stop;" and the other half down, which is a signal "to advance with caution;" and in like manner each lamp has two lights, a red and a green, (two of the faces of the lamp being left blank) the red corresponding with the "stop" position of the arm, and the green with the "advance-with-caution" position. The rods (H H), which work the four sets of arms and lamps, terminate each at bottom in a lever P, of two arms of unequal length, which is centred on a pin projecting from the post. From the end of the long arm, a chain Q^1 is carried down through the platform, then over a pulley R, and thence across to the opposite side of the hollow space beneath the platform, where it is passed up again through the platform, and carried over a pulley V, mounted in a rectangular iron frame X, screwed to the top of the platform, from which pulley it hangs suspended with a stirrup U, attached to the end of it. A front view of the frame X, is given separately in fig. 4. U U U U, are the four stirrups of the four chains Q^1, which command the signal-rods H H; they are all on a line, and within a easy reach of an attendant standing in front of them, who has but to press down with his foot the stirrup of the chain which he wishes to act upon. Immediately behind the frame X, and also within easy reach of the attendant, are two handles W^1, W^2, which command the switches at the junction-points of the two railways.

When the attendant signalises that the way is clear to a carriage or train to pass from one railway to another, which he does by pressing down the stirrup which commands the left arm and corresponding lamp, (that is to say, the left arm and lamp, as regards the driver,) and thereby at once lowering the arm halfway, and bringing the green face of the lamp in front of the coming carriage or train, he at the same time, or immediately before, or immediately after, stretches his arm over the frame X, and pulls towards him the handle which commands the junction switches. On removing his foot from the stirrup, (letting free at the same time the switch-handle) the signal-arm and lamp are immediately restored to their original positions by a counterpoise Y, which is suspended from a chain Q^2, attached to the short arm of the lever P, and passed down through the platform. The arm remains always extended straight out, until it is lowered by the attendant; and when in that position the red light is of necessity invariably exhibited, so that until the attendant has, by lowering the arm halfway down and thereby bringing the green light in front, intimated that he has adjusted the switches, and that the way is clear, an unmistakeable warning is given to the coming carriage or train that there is danger in advancing.

In situations where it may be desirable that the signal-arms and lamps should be acted upon from a greater distance than can be conveniently reached by chains, the patentee proposes to employ a metal tube, or a series of tubes, which shall communicate at the end where the signal-man is stationed with a bag or case, made of vulcanized caoutchouc, gutta percha, or some other like air and waterproof material, and at the other end, or that end adjoining the arm and lamp levers H, with a like bag or case, and that each bag or case shall be enclosed in a box, with a lid attached to the box all round, by some air-tight elastic or flexible joining, which will allow of its rising and falling as acted upon from beneath. These bags and intermediate tube or tubes are to be filled with air in a state of considerable compression. To the lid of the box at the signal-post end, there is attached a joint-rod, which, on the rising of the lid, pulls down the arm and lamp-levers H. It follows, that when the bag or case at the end where the signal-man is stationed is compressed by means of a screw-plate, shifting weights, or otherwise, a rising motion will be instantly communicated to the lid of the box at the other end, which, through the medium of the joint-rod, will impart a descending motion to the signal-rods H. On removing the pressure from the bags or cases, the enclosed air will of course be immediately restored to a state of equilibrium, and the arms and lamps return to their original position.

The reflectors of the lamps are made of a parabolic section, and protected in front by the coloured glasses, which are made of a convex form, and fixed hermetically close in their places. With oil, the patentee uses the ordinary Argand burner; but when gas

Digitized by Google

is employed, he uses, in preference to any of the ordinary gas-burners, one possessing the following peculiarities:—The nozzle is encircled by a cylindrical ring, and is made circular with a conical top, and the holes in it are pierced obliquely, so as to cause the ignited streams of gas to impinge against the sides of the cylindrical ring.—A rod, passes upwards from the throat of the gas supply-pipe through the nozzle and to a considerable height above it, where it terminates in a circular spreader. By thus causing the streams of gas to diverge at bottom towards the sides of the cylindrical ring, and carrying the spreader so much higher than usual above the nozzle, the patentee obtains not only a much broader but a much longer flame than usual, and at the same time ensures a more perfect combustion of the gas. The burner, whether of the Argand form, or of the above improved form, may be made of brass, or iron, as usual; but Mr. Stevens prefers making it in manner following:—"I first cast a core or matrix of the required form in some metal or material easily fused or melted, as zinc, or lead, or wax; I then, with the aid of an electric battery, deposit upon it a covering of copper (the mode of doing which is well known) or other hard metal; I afterwards melt out the core, which leaves the burner complete, requiring only a little finishing to be ready for use; I thus obtain a burner, which, from its extreme thinness, offers much less obstruction to the currents of gas and air than those made in the ordinary way, and which, also, from the greater purity of the metal of which it is composed, is less liable to oxidation, and will last longer."

ON RAILWAY BUFFERS. BY SIR GEORGE CAYLEY, BART. (IN CONTINUATION FROM P. 223).

Sir,—Your Birmingham correspondent, "G. M.," asks, very properly, "What would be the effect upon the rods when one buffer might be three or four inches higher or lower than the other, and consequently, *both* bearing within the cylindrical box? I presume this, with the blows from the agitation, would soon prevent the free working of the rods." Since my communication was sent to you upon the subject of locked buffers, I have taken every opportunity in my power of examining, on various lines, how far the accuracy with which the opposing buffers of contiguous carriages, as now made, would admit of the lock principle being applied to them; and I am sorry to find, that a large proportion of carriages have their buffers so unequally arranged as to elevation, frequently varying three to four inches from being central to each other, that if furnished with the cylindrical caps of the locked buffers, they would never have the opportunity of showing the evils "G. M." suggests; for they could never efficiently coincide, so that one could *grasp* the other—without which the proposed locked action is not effected. Whenever they are central enough to grasp each other, these evils would not occur. It is mainly in the elevation and depression, and not in the lateral position, that the present irregularities take place. Of course, they are *intended* to be central; but from the want of proper means of adjustment they fail in this respect; and when that failure approaches nearly to half the width of the buffers, they are then in a dangerous position, and ready to override each other.

If the locked buffer principle be capable of nearly extinguishing the risk arising from a great class of accidents—though it cannot, as I at first thought, be applied to most of the carriages in present use, without some adjustment in the beds to which the springs are attached, so as to regulate their height; yet, surely, if these carriages do admit of any such arrangement, the experiment ought to be tried on some of those that fit each other well, and then extended to others, as experience proves the advantage of the principle. In new carriages, the beds of the springs should be so made as to enable the buffers to be adjusted, by regulating screws, to one uniform elevation, when unloaded. There is no necessity to make the receiving-box of the buffer a tight fit to its opponent; an inch of play between the iron posts would be almost necessary; the soft stuffing alone ought to be a tight fit, and that only when fully up, the receiving-box being conical to admit of their meeting, although some irregularity of elevation may exist.

The question of central buffers, instead of side-buffers, is noticed also by your correspondent "G. M.," and it is a point that deserves much more consideration than it appears at a glance to demand. The violent lateral vibration of each carriage separately, is the great evil to be overcome; and, by some means or other, a train ought to be so firmly connected, that its action, as a whole, should more

Digitized by Google

resemble the steady gliding of the long body of a serpent, than the loose rattles at its tail. The tension by which each carriage is dragged forward, is, by the present screw-shackle, *central;* and no doubt it ought to be so, for this central tug, fore and aft, generally tends to draw each carriage from its lateral vibrations, which when in excess may carry it off the rail; yet a central tug, if unconnected with the broad lateral bearing of the present buffers, might, when the two contiguous carriages happened momentarily to coincide in lateral vibration, prove no check to each other. The buffers being tightly braced up, makes each carriage partake in some measure of the movements of the two others it is thus connected with; and the locked buffers will very greatly increase this beneficial action, as it does not permit of any *side* slipping, and compels each carriage to take a sort of average movement, which in a train, being the result of many incongruous impulses, will be nearly neutral.

The operation of buffers of any sort in their present position, when the train is passing a curve, requires ample consideration upon sound data as to the forces in action in any particular case. Take the following, as a rough approximate estimate of an average case:—Suppose a train to consist of twenty carriages, weighing four tons each; and that on an average of weather, dust, &c., the traction of the engine amounts to a hundredth part of the weight of the train; then the tension on the central screw-shackle between the tenth and eleventh carriage, is the hundredth part of forty tons, or about 900 lbs. Suppose the train to be passing on an abrupt curvature of fifty yards radius, and that the buffers had been drawn up to bear firmly against each other when on a straight rail, the force required to commence a movement in any of them is about 200 lbs;* and at this curvature the inner buffers will be compressed about two inches and a half each, which will generate a force of about 550 lbs., or more than half that of the tension of the shackle. The shackle therefore becomes a fulcrum, around which each carriage endeavours, by the force of its compressed inside buffers, to restore itself to a direct line. The external rail receives this lateral pressure, about 16 feet from the fulcrum, by the flanches of the two furthest wheels of each contiguous carriage. The compressed buffers operate at a distance of about 2 feet 10 inches from the fulcrum; and hence the pressures, being inversely on their distances from their common fulcrums, the force of these wheels against the rail will be about 90 lbs., operating to shove the wheel over the rail, and taking advantage of any occasional jumps or lift that may occur to aid this force. If the buffers were *locked*, this side-pressure would be distributed along the line of carriages; and the *general* action of the train, as a whole, would be obtained; all the carriages partaking in part of any nascent irregularity of movement in any particular carriage, which would be thus prevented going beyond its due average of lateral action, and also of vertical jolting.

We are too far from a "perfect system," as one of your correspondents says, to go more accurately or minutely into this sort of reasoning, and this rough sketch may suffice for the present as to this part of the subject. When fearful destruction, on some sweeping scale, has taxed human invention to its utmost to make railway travelling as safe as the case admits of, other views will become open to us. I will venture one hasty glance at the shadow of the coming time.

In the first place, light-formed carriages, as now used, which have been rashly adopted from those in use on our common roads, have to be superseded by those more appropriate to the altered nature of the case. These carriages will probably consist of such strong diagonally-braced framework of wood and iron as will defy all "smashing." The interior may be as elegantly adorned, and as softly stuffed, as the most delicate lady may require; but the framework, however ingeniously it may be concealed, must be like the shell of the tortoise, strong enough to preserve the *living* principle within. These carriages will require to be firmly coupled to each other, fore and aft, by a strong vertical bolt, removable at pleasure, which may pass through an eye in two iron straps or connecting-rods, that form part of the

* I measured the power of the buffers manufactured by Messrs. Wright and Co., and it seems that the force required to commence any movement of an ordinary buffer is about 200 lbs., the spring being so adjusted. The range from this commencing point is 1 foot; and the ultimate force when pressed home is 1,960 lbs.

Digitized by Google

Fig. 2.

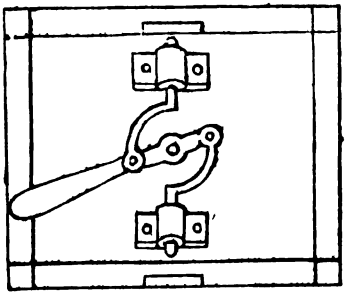
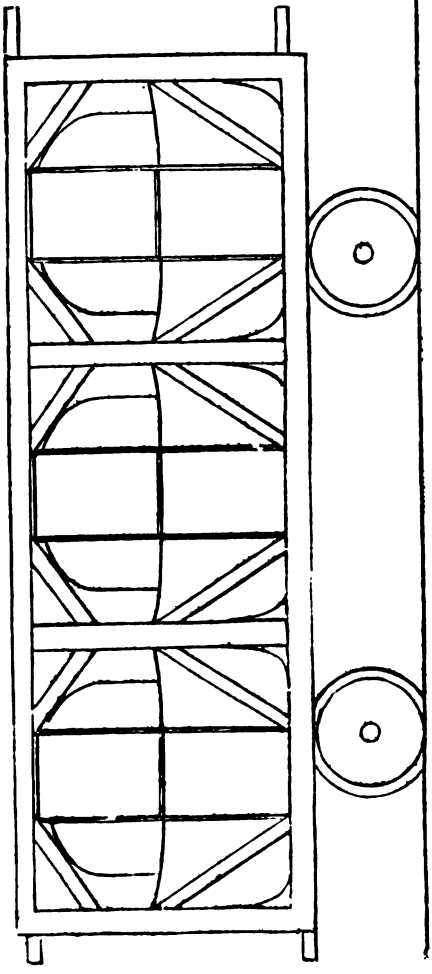


Fig. 1.



roof and floor of each carriage, and are central with the carriage lengthwise. These connecting-rods will exceed the length of the carriages sufficiently to admit of some sort of buffers on each side, so that the train may accommodate itself to curves. But as such buffers will have no effect in softening concussions, this construction implies the necessity of having a carriage entirely contrived for buffing, placed at each end of the train, as has frequently been urged as the best means of safety from collision; and in time i will probably be found necessary to do even more, and allow a buffing-carriage to intervene between some given number of carriages in every train. Figs. 1 and 2 will give a general idea of such carriages, and the means of bolting them together readily and firmly; fig. 2 being an end view of the body of the carriage and bolt only.

It is evident, that by this method of coupling carriages so strongly framed, a train might pass over 30 or 40 feet of broken bridge, or embankment, uninjured; all the carriages being suspended as on a firm beam or bridge of framework, more extended than the chasm—and even the engine and tender might be sustained, if so coupled, over many feet. If this be a dream of the shadow of the coming time, I admit it is a tolerably *substantial* one: but I affirm, that such results are positively within the range of mechanical invention; and the sooner they are worked out into a practical form the better.

I have now had an opportunity of reading Mr. Sutton's letter of June 20, 1845; and there can be no doubt that gentleman had an idea of *locked buffers* earlier than any one who has hitherto noticed them: his idea does not much interfere with my own views on this subject, as he confines them only to come into action at the time some strong shock is received by the train, by which it is stopped. I want them for constant service, and for several other purposes. Mr. Sutton says, "If these buffers are furnished with a plug and key-sort of adjustment, they may, when a severe shock takes place, become firmly keyed or locked into each other; and thus the whole line of carriages, at least those which are in the vicinity of the shock, will become as one body, immovable; no running over each other, or overturning,

Digitized by Google

as they are, as one carriage, firmly united with the buffers, but which may be instantly disconnected by suitable gear." Mr. Sutton's buffers, if well carried out, would probably have prevented the accident at Wolverton; and he has the credit of inventing them before that accident led others to think upon the subject.

I am, Sir, yours, &c.,

GEO. CAYLEY.

SAFETY TELEGRAPH FOR RAILWAY TRAINS.

Sir,—Frequent is the occurrence of accidents to passengers in railway trains, which might be mitigated or prevented were any means in use of warning the engine-driver of their danger.

Some suggestions for this purpose have been before the public, of the inefficiency of which their non-adoption is proof. The recent invention of a whistle, to be sounded by the guard of the train, is the best of these, and, within the limits of its applicability, very good; its protective agency is, however, but partial, since grievous casualties may occur beyond the cognizance of the guard; or a train may be severed by the fracture of the link between two carriages, and the guard, with his whistle, may be left in the lurch, out of hearing, before the signal could be uttered.

A suggestion is here offered, which occurred to the writer while reflecting on the inadequacy of this and similar contrivances to the purposes of safety.

Let the last carriage of every train contain a guard and a small voltaic battery; from this battery let one of the conducting-wires proceed directly to the axle of one or both of the pairs of wheels of this carriage, with which contact may be maintained by a spring. Let the other conducting-wire pass out at the fore-end of the carriage, just under the roof, and there terminate in a spiral link of wire of sufficient length to reach to the carriage next in front. Let the next, and each other carriage of the train, up to the tender, be furnished with a wire running under its roof, from end to end, not in contact with any metallic part of the carriage. Let each such wire be continued at one extremity by a spiral link, for attachment to the wire of the next carriage. Let each vehicle occupied by human beings be supplied with pairs of forceps, one at least for every compartment; and let each of these nippers be enclosed in a case, with a glass front, sealed in, in some conspicuous and convenient position, so that, in case of danger, the glass might be broken, and the wire cut. Or, instead of these last, let the longitudinal wire be interrupted, in each compartment of the carriage, by a smple contact breaker, in a glazed frame, of which the guard should keep the key: let this officer satisfy himself before starting that all the contacts are "turned on;" then the "Danger-signal" may be made by a single movement indicated by a plain direction lettered on each break.

This arrangement being repeated in every carriage up to the tender, let the system be continued by an insulated wire running to the fore-part of the tender, and here let it enter the alarm apparatus, which should be insulated, and close to, but out of reach of, the engineer and stoker; the guard having the keys.

Let this alarm consist of a small electro-magnetic core and coil; the armature of the magnet being adjusted as the detent of a clock movement. Let the clockwork be connected with a bell, so that, on the release of the detent, the spring shall be free to act, and the bell shall commence to ring violently, and continue to do so till the detent be recalled by the magnet.

Let then the series of conductors be continued to the electro-magnet, and, having formed its helix, let the wire pass on to the wheel-axles of the tender, its extremity being kept in contact therewith by a spring.

The expense of this adjustment would be trifling. The trouble it would entail would only be that of occasionally winding up the alarm-spring, of tightening a little binding screw between each two carriages on making up the train, and of keeping the battery charged; and this last item might be eliminated by substituting for the battery a magneto-electric apparatus, the revolution of whose armature might be made to depend on that of the wheel of the carriage.

It is clear, that, so long as contact is maintained, the "current" will pass through the series of carriage-wires, through the alarm, and back through the rail to the battery; and that whenever either the guard suspends contact at the battery, or a passenger cuts the conductor, or the train breaks, or the last

Digitized by Google

carriage (the most liable to do so) gets off the rail, the "current" will instantly cease, the clockwork will be freed from the magnet, the bell will ring, and the train will soon be stopped.

The only errors to which the system would be liable, are false alarms on the safe side. These might occur by a passenger's wantonness,—not likely to be repeated; or by momentary non-conduction between the rails and wheels; and, in this case, conduction would probably be resumed, and the bell would cease to ring before the engineer could have done more than shut off the steam.

Should the last error be found to occur so frequently as to be inconvenient, the circuit might be maintained by a second set of wires similar to the first, instead of trusting to the rail: this would add but little complication to the scheme, and would only sacrifice the additional safety in the chance of the last carriage quitting the rail without the instant knowledge of its occupant.

Hoping, that, if this sketch should be deemed worthy of a place in your pages, it may be intelligible to your readers,

I am, Sir, yours, &c.,

C. B. M.

Sept. 21, 1847.

HORÆ ALGEBRAICÆ. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.*

(Continued from page 308.)

V. SURD EQUATIONS.

In the equation

$$1+\sqrt{1+x}=0 \ldots\ldots\ldots\ldots (1)$$

(where the positive value of the radical is to be taken) for x substitute $\alpha+\beta\sqrt{-1}$, α and β being any real quantities. Then (1) becomes

$$1+\sqrt{1+\alpha+\beta\sqrt{-1}}=0$$

which is equivalent to

$$1+\alpha'+\beta'\sqrt{-1}=0$$

α' and β' being real (*a*). Hence

$$\beta'=0, \text{ and also } \beta=0;$$

consequently x is real. But no real value of x can satisfy (1), for, if so, we should have the sum of two positive numbers equal to zero, which is absurd. The equation (1) has, then, no root real or unreal—a result "very startling to all our preconceived notions of the constitution of an equation" (*b*).

In a valuable "NOTE," at pages 130—133 of the fourth edition of his *Algebra* (*c*) Professor Young treats the equation

$$(2x-5)+\sqrt{x^2-7}=0, \ldots [A]$$

in a manner the same in principle with that just employed in the discussion of (1). He there shows that no real and no unreal value of x [that is to say, no unreal value of the form $\beta\sqrt{-1}$] can satisfy it (*d*). But when x is assumed to be of the form

$$\alpha+\beta\sqrt{-1},$$

is the argument of my distinguished friend still applicable? It appears to me (although I say it after considerable hesitation, and with great diffidence), that in this latter case, owing to the obliteration of the original conditions by involution (*e*), combined with the uncertainty and difficulty that attend all attempts at the solution of surd equations (*f*), we shall not easily arrive at a positive conclusion as to the non-existence of roots of [A]. Such a conclusion would follow at once from a consideration of the effect which the existence of a root of [A] would have on its congeneric equation (*g*); but I do not at present see anything on the face of the given equation to indicate that its solution is impossible (*gg*).

Let it next be required to solve the equation

$$10-2x-\sqrt{(4+x)(5-x)}=0 \ldots (2).$$

Transposing the radical, squaring, reducing, &c., we have at length

$$(-x)^2+\frac{41}{5}(-\ )=-16$$

or, solving this last equation as we have already done a previous one (*h*),

$$-x+\frac{41}{10}=\frac{9}{10},$$

---

* The *Horæ* were interrupted during part of August and the present month by Mr. Cockle's absence in Holland and Belgium. Mr. Cockle hopes now to continue them alternately with the remainder of his *Chapters on Analytical Geometry*, commenced in this work. *Coston*, near *Waltham, Melton Mowbray*, September 25, 1847.

(*a*) See Professor Young's *Algebra* (4th ed.) p. 115, note.

(*b*) *Gentleman's Diary* for 1837, p. 34.

(*c*) London, Souter and Law, 1844.

(*d*) Page 132, lines 3 to 10.

(*e*) Young's *Algebra* page 131 (4th ed.).

(*f*) *Supra*, pages 135, 136.

(*g*) *Vide supra*, page 151.

(*gg*) And see a doubt expressed at page 128 of WOOD'S *Algebra*, (Mr. Lund's edition).

(*h*) *Supra*, page 135, equation (5).

Digitized by Google

whence $x = \frac{32}{10} = 3\frac{1}{5}$.

The above equation (2) is congeneric with that proposed as the Example 8 at page 130 of Young's Algebra (4th ed.). I hope on a future occasion to give a set of Rules respecting surd equations. Suffice it to remark here, that it is not a matter of indifference to which of a number of congeneric equations we apply the symbolic test. The last equation (2) is of nearly the same form in every respect as those marked (5) and (6) *supra* page 135. In all three cases the available root is the *least* root, and one root of the final quadratic belongs to each of the congeneric equations.

(*To be continued.*)

CAST IRON GIRDER BRIDGES.

Fig. 1.

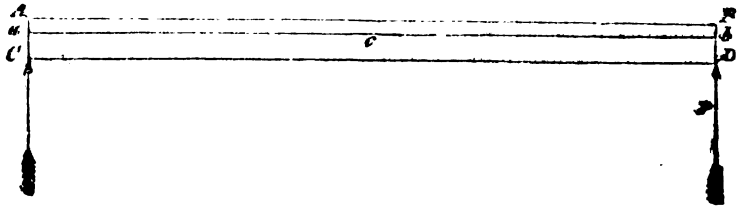
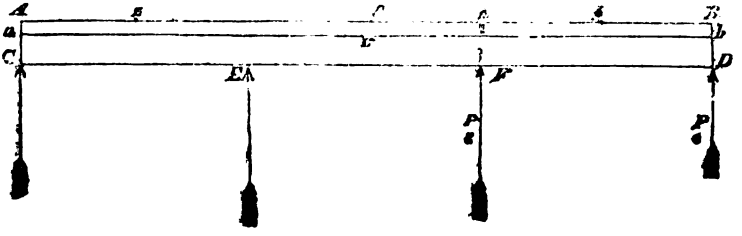


Fig. 2.



Sir,—Without, for the present, recurring to my original paper: Let ABCD, fig. 1, be a girder resting horizontally on the abutments CD. Put $2L = AB$, μ = the weight of each unit of the beam, and load, P_1 = the upward pressure of the abutment D, and let M = the sum of the moments of elasticity round any point c in the neutral line, when

$$M = P_1\overline{cb} - \frac{\mu}{2}\overline{cb}^2 = \overline{cb}^2\left(P_1 - \frac{\mu}{2}\overline{cb}\right).$$

Which when c coincides with the centre of the beam $\overline{cb} = L$, and $P_1 = \mu L$, or

$$M = L\left(\mu L - \frac{\mu L}{2}\right) = \frac{\mu L^2}{2} \ldots\ldots\ldots\ldots\ldots\ldots (1).$$

Let us now suppose the girder be proped, as in fig. 2, by the props E and F, and suppose these props to divide it into three equal parts, then $CE = EF = FD = \frac{2}{3}L$. Put P_2 = the upward pressure at D, and P_3 = the pressure F, then if M = the moments of elasticity round any point c, in the neutral line between the props E, and F, and μ_1 = the weight of each unit of the beam and load.

$$M = P_2\overline{cb} + P_3(\overline{cb} - \overline{FD}) - \frac{\mu_1\overline{cb}^2}{2}.$$

Or if c be the centre of the girder, then

Digitized by Google

$$M = P_2 L + P_3 (L - \frac{2}{3} L) - \frac{\mu_1 L^2}{2}$$

$$= L \left(P_2 + \frac{P_3}{3} - \frac{\mu_1 L}{2} \right) \ldots\ldots\ldots\ldots\ldots (2).$$

Which is the same as the equation in "A. H.'s" communication. Now, *on the supposition* that the abutments and props each support symetrical portions of the beam, the abutment D would have resting on it half the weight of the beam, and load between D, and F, or the upward pressure at $D = \mu_1 z\overline{B} = \frac{\mu_1 L}{3} Bz$ being $= \frac{1}{2}$ of $ED = \frac{1}{2}$ of $\frac{2}{3} L = \frac{1}{3} L$. Similarly the prop F would support the beam and load contained between the points y and z, or the upward pressure at $F = \frac{2 \mu_1 L}{3}$ because $yz = \frac{2}{3} L$: and so on for the other prop and abutments. Substituting these values for P_2 and P_3, equation (2),

$$M = L \left(\frac{\mu_1 L}{3} + \frac{2 \mu_1 L}{9} - \frac{\mu_1 L}{2} \right) = \frac{\mu_1 L^2}{18} \ldots\ldots\ldots (3).$$

Comparing equations 1 and 3,

$$\frac{\mu_1 L^2}{18} = \frac{\mu L^2}{2} \therefore \mu_1 = 9 \mu \ldots\ldots\ldots\ldots\ldots\ldots (4).$$

Which is the same result as I arrived at in my first paper, and must be correct if we *allow* the *assumption* as regards the upward pressure on the props. I have given my reason for assuming these relative values of P_2 and P_3, and can say no more on this point, further, than that I think I am borne out in the principle by writers assuming that each of the *vertical* rods of a suspension-bridge are strained *in proportion* to the *distance they are apart.*

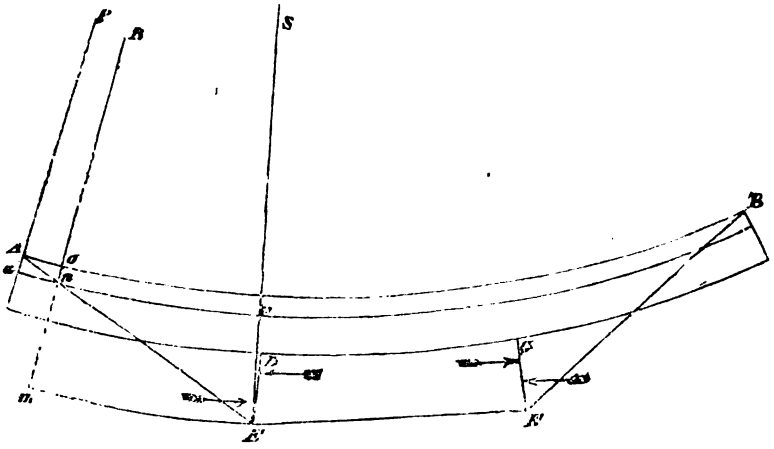
The foregoing equations are not brought out exactly on the principle I originally proceeded: for I then intended your readers to imagine the girder separated into three distinct parts or segments, by being cut through, over the props E and F; and, for the sake of easy comparison with the foregoing equations in my first letter, I computed it as though the whole load of each segment of the beam was collected over its respective centre. "A. H." will therefore see, that, with this view, there were no more forces to be taken into consideration than was at first computed, and that the re-action of the abutment, inasmuch as it acted on a distinct and separated portion of the beam, would not at all affect the condition of equilibrium of other parts of the beam. I might not, in my original paper, have expressed myself so clearly on these points; yet, when they are taken into consideration, the reasoning will not appear so absurd as "A. H." would lead us to suppose. Neither did I contradict myself when I said, "the reason I assume $\frac{2}{3} L\mu$ to be the weight on each prop," &c.; for "A. H." will see, that, if $\frac{2}{3} L\mu$ be the *weight* supported by F, μ, $\frac{1}{3} L\mu$ will be the *upward pressure round the centre c*, if the girder is divided in the line nF, the remaining $\frac{1}{3} L\mu$ being an upward pressure acting on the segment FB.

With regard to the next question, "A. H." and myself seem scarcely to understand each other. In his first letter, his observations seem to imply, that the inclined bars AF would give way before the bars EF. Diagram, fig. 2, in his last letter, appears to refer to the props ED, GF, which he apprehends would be broken by the cross strain, as represented by the arrows.

With regard to the bars AE and BF, I have in a previous letter shown that they are not as much strained if fixed to the beam at A and B, as the horizontal truss-bars EF; but, lest there should be any doubt on this point, draw aAP, (fig. 3) *mno*R, E*ps* normals to the neutral line

Digitized by Google

Fig. 3.



at the points *a*, *n*, and *p*, and from E draw E*m* parallel to *np*. Now, for a moment, let us suppose *n* to be a solid abutment in the neutral axis, and the bar AF to be divided at the point which coincides with it; and let the upper segment A*n* be fixed at A and *n*, and the beam deflected by extraneous pressure till it assumes the curve above represented: then, because *a n* is the natural length of fibre, and A*o* is a parallel fibre, but by reason of the pressure reduced in length, it follows that any line joining the points A*n* will be proportionably reduced, and therefore proportionably compressed; and because the line E*m* is longer than the line *np*, measured on the neutral axis, any line joining the fixed points *n* and E will be extended.

Hence, taking the whole bar AE, the total extension will be equal to the difference between the extension and compression of the segments considered separately.

I would have replied to "A. H." earlier, but preferred letting the subject stand over until after my return to London.

I am, Sir, yours, &c.,

WILLIAM DREDGE.

P.S. In my last letter, p. 206, col. 1, line 46, read *cosec* for *cos*.

10, Norfolk-street, Strand,
Sept. 23, 1847.

AYCKBOURN'S FLOAT, LIFE-PRESERVER, AND SWIMMING-BELT.

[Registered under the Act for the Protection of Articles of Utility. Mr. F. Ayckbourn, 30, Palace New Road, Lambeth, proprietor.]

The present Life-preserver is distinguished from other inventions of its class in being constructed so as to be worn under any article of clothing, either by male or female, and in requiring to be but partially inflated, so that it can never burst. Unlike other belts, too, its supporting medium is applied to the chest, which is the part of the body obviously most in want of its aid, owing to the superincumbent weight of the head and shoulders. When used simply as a life-buoy, it is stated to be capable of supporting three or four people.

To construct this life-preserver, two pieces of cloth, which have been previously coated on one side with dissolved India-rubber, are cut into the shape represented in fig. 1, and passed between rollers, to make their coated surfaces adhere together, after which the compound piece of cloth is doubled or folded over into the form shown in fig. 2. The two outer edges of the cloth, as far as the dotted lines, are then coated internally with liquid India-rubber, and a strip of the waterproof material, before mentioned, coated with India-rubber, laid between the edges of the cloth, so that the centre of it comes where the open

Digitized by Google

Fig. 1.

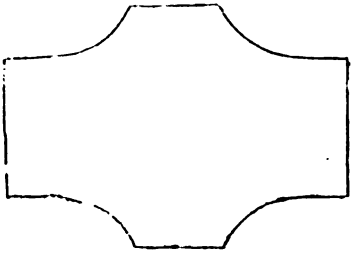


Fig. 2.

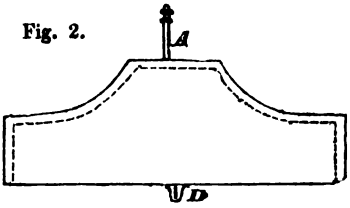
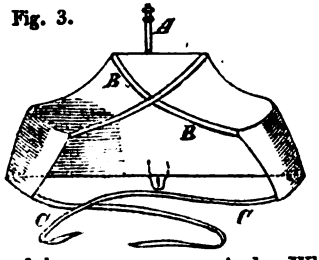


Fig. 3.



sides of the preserver are united. When the edges are thus firmly cemented together, the article forms an elongated bag, both air and water-tight. A is a short piece of vulcanized India-rubber tubing, by which the bag may be inflated with air at pleasure; B B are two straps, for passing under the arms and over the neck of the wearer; C C are other straps which tie in front, after passing through the loop D. Fig. 3 shows the article in its complete state.

CURR'S "RAILWAY LOCOMOTION AND STEAM NAVIGATION: THEIR PRINCIPLES AND PRACTICE."*

The circumstances under which this book has been written, the evident wish of the author to be useful, and, we may add, the amusement some of his declamations have afforded us, induce us to give to it a more extended notice than it would otherwise have any claim to. It appears that Mr. Curr, whilst an engineer in England, some thirty or forty years ago, had a dispute with several of his professional brethren (Mr. Maudslay amongst others), and was so disgusted at "finding ignorance silvered over with plausible appearances," that he quitted the profession, and transferred himself and his acquirements to New South Wales; where, however, it does not appear that they were any better appreciated. A railway being proposed from Sydney to Goulburne, Mr. Curr sent in to the Committee his plans:

"Although thirty-two years had passed since I relinquished that profession, I was induced to commence an examination of the principles of steam conveyance on railways; the result of which was laid before the Committee in different papers, and forms the matter of the following pages, in so far as they relate to that subject. That those papers were considered valueless, and consigned to the shelf of oblivion, was evident from their subsequent report; but, knowing them entitled to consideration, they were put in the form in which they now appear, with the intention of being made an eleemosynary tribute to the British Government, for the benefit of the British nation, if, by chance, their usefulness or value should be detected."

The *Inflexible*, sloop of war, Commander Hoseason, arriving in the harbour of Port Jackson, induced Mr. Curr to inspect her:

"The result of that inspection was a suspicion that steam navigation, notwithstanding the thirty-five years which have expired since its importation across the Atlantic, is no better understood than on the day of its being landed; and which, by a careful examination of two volumes and two odd numbers of the *Mechanics' Magazine*, made in order to ascertain the present actual and scientific knowledge of English engineers on the subject, was fully confirmed. In consequence, the above-named charitable intention has been abandoned. * * * The result of such change of purpose is, that of having quitted a peaceful homestead in the fair clime of Australia, and these lines are being penned on board the ship *St. George*, bound from Sydney to London; so, that, in the monotony of passing over 16,000 miles of the hungry ocean, where all above the horizon is interminable blue, and all below differing only in shade and extent, an occasional excursion from the straightforward path becoming an essay on mechanical subjects, may in this address find pardon from the reader."

* 181 pp., 8vo., Williams and Co., 1847.

Digitized by Google

It is not often that authors can plead such an excuse for their rambling. To confine the body in a ship's cabin, and the mind to a straightforward argument at the same time, is certainly rather more than can be reasonably expected, and we are thereby enabled to attribute the want of connection in the writer's reasoning to the lurching of the ship, and the obscurity of his notions to a passing fog.

One of the chief objects of the book is, to arouse the nation to a sense of the awful peril they incur in trusting to "Hutton's Mathematics." Our readers have been accustomed to look upon their copies of this work as, at the worst, a very harmless mass of paper and ink, little dreaming of the fearful destruction with which it is fraught. "To his (Hutton's) doctrine of hydrostatics might fairly be attributed the bursting of steam-engine boilers, the blowing up of public sewers, and the breaking down of brewers' vats; so that his course of mathematics is equally a national misfortune and disgrace," (page 49). Against poor Hutton, and "all his followers," Mr. Curr is determined to wage war—"war even to the knife." To assuage in some degree the mortal antipathy which Mr. Curr feels towards all critics, as set forth in the concluding paragraph of his book, (and which we shall treat our readers to presently,) we beg most solemnly to assure him that we are quite innocent of ever having read one line of Hutton's Mathematics, and know nothing whatever about it; excepting the last edition, edited by Professor Davies, in which all the parts relating to mechanics and hydrostatics have been removed, to make way for more extended treatises on geometry, &c. Consequently, we are really quite horrified at the account which Mr. Curr gives of the work, which horror, however, is somewhat alleviated by the ludicrous:

"We will, however, follow the doctor to a practical case, when we shall see the capers he cuts, and the agility he displays in endeavouring to extricate himself from the shaking quagmire on which he finds himself: viz., to shift the momentum from v, as given in his original theory, to v^2 in a practical case."

The idea of old Hutton cutting capers on a shaking quagmire, is one of the most pleasing and refreshing images which has been presented to our imagination for some time, the scene being enhanced, if possible, by the introduction on the stage of "Mr. Tredgold, whom he (Hutton) let into his own quagmire"—the two philosophers dancing a jig on the said quagmire to the tune of v^2!

As a specimen of Mr. Curr's notions in mechanics, we extract the following, which we have no doubt will be abundantly sufficient:

"W. Emerson, the translator of Sir Isaac Newton's Principia, and the only mechanic of the past century" (the monopoly must have been a valuable one,) "has given the relative momentum of a falling body, as compared with the same at rest, and says,—Let b = body or quantity of matter; F = accelerated force acting uniformly and equally on the body b; v = velocity generated in b by the force F; m = the motion generated in b (by some writers, as he says in his definitions, called the momentum); s = space described by body b; t = time of describing space s. Amongst other rules of proportion, he makes m proportional to bv, that is, to the product of the quantity of matter and velocity. Before proceeding in the examination, it will be proper to have a distinct perception of the term velocity, which, in the case before us, may be distinguished as absolute velocity and acquired velocity. Absolute velocity, according to the definitions of both Hutton and Emerson, is the space passed over by a falling body in respect to a body at rest, and, consequently, is equal to the space or distance the body has fallen; so that absolute velocity is taken or measured, irrespective of the time of falling. Acquired velocity has not been especially defined by either writer, and therefore will be taken in the sense in which the term is universally used, viz., the velocity in respect to any particular time, usually in feet in the time of one second; or as the space in feet that would be passed by the body in one second, in case its velocity were to be continued uniformly after having assumed that velocity per second. I now say the obvious plain reading of Emerson is, that m, the momentum generated in the body b when it has been acted on by the force F, and has described the space s, whatever be the time in which it has described that space, is proportional to bv, or to the product of the body and the *absolute* velocity; being equivalent to the

Digitized by Google

product of the body and the space it has fallen, and which is consequently the weight of the body multiplied by the space it has fallen. Dr. Hutton, treating on the same subject, says,—Put b = any body or quantity of matter, f = force constantly acting on it, t = time of its acting, v = velocity generated in time t, s = space described in that time, m = momentum at end of that time. The plain reading of Hutton then is; m the momentum at the end of the time t, when the body b has been acted on by the force f, and acquired a velocity v in that time, and whatever space it may have described in that time, is proportional to bv, or to the weight of the body multiplied by the *acquired* velocity. The acquired velocity being as the time, or as the square root of the absolute velocity, Hutton and Emerson consequently differ as bv to bv^2, although each represent the momentum in the same symbols, or as proportional to bv."—(Pages 37—39.)

It would be difficult for any man to give more convincing proofs of his utter and complete ignorance of the very first elements of dynamics, than are contained in this extract. The confusion and complete absence of anything like one distinct idea of the real meaning of the terms used in mechanics, could not be more thoroughly manifested. Without ever having read either "Emerson's Mechanics," or Hutton's—we venture to assert, that no such definition as that "of absolute velocity" mentioned by Mr. Curr is to be found in their books The distinction between *absolute* and *acquired* velocity exists nowhere except in the author's own confused notions. Although queerly worded, he does seem to have something like a correct notion of that which he terms "acquired velocity," and this is the only velocity ever thought of, or talked of, or written of, by any author on the subject. It is not a gracious office to have to tell a man for whom, both on account of his age and the labour with which he has endeavoured to acquire knowledge, we entertain a sincere respect, that he has yet to learn the very alphabet of the science he is now professing to teach. The subject, we are well aware, is one of extreme difficulty to every beginner; and when, as in Mr. Curr's case, he is deprived of all assistance by a residence in such a place as Australia—and at an advanced age has to grapple with what we have no hesitation in saying are very formidable obstacles to every one—it is no disgrace to fail. One-tenth part of the labour which Mr. Curr has evidently bestowed on the matter, *if it had been under proper guidance*, would have not only prevented his committing himself by writing such a book, but have probably enabled him to do good service to others from having acquired distinct knowledge himself. These remarks apply to the whole contents of the book. Facts and laws "as old as Adam" are to the author as utterly unknown and new as to any inhabitant of the Australian bush: of this we shall see presently a very striking example in his observations on the expansion of steam. To return, however, to the "velocity" question:—When Galileo first began to lay the foundations of dynamics, two centuries and a half ago, he imagined that the velocity of a falling body increased in proportion to the distance over which it had passed—but he very soon found out his mistake; and no one has ever since dreamt of such a thing that we know of, except Mr. Curr, whose notions look very much like it. We cannot convert this notice into an elementary treatise for Mr. Curr's benefit; but as he has done this Magazine the honour of considering it as the exponent of the "present actual and scientific knowledge of English engineers," we take the liberty of suggesting, that he may find something to assist in enlightening and clearing up his conceptions in some of the recent numbers of this Journal.

With regard to the author's observations on railways, the reader will be able to judge of their value, by the simple fact that Mr. Curr takes for granted, almost as an axiom, that "when the velocity of an engine is doubled the friction is doubled," and so on! We again take the liberty of informing Mr. Curr, that really other people besides himself *have* inquired into these matters, and that thousands of experiments have been made by some of the most careful and skilful men, the results of which he may

Digitized by Google

find in almost any modern work on the subject; (as, for instance, "Moseley's Illustrations of Mechanics; or, Treatise on Engineering and Architecture,") and the results are, amongst other laws, that the friction "is wholly independent of the velocity of the motion."

Some remarks are made about the economy of high speeds, as compared with low ones, which are in some respects true enough, and also stale enough—the amount being pretty nearly to the effect, that if an engine go at twice the speed, and therefore in half the time, the wages of the engineer and other servants will be also halved. Q. E. D.

Some of the remarks on the precautions against accidents are sensible enough, but if they have not already occurred to 99 out of 100 engineers, it would be rather wonderful.

One sentence, however, is *really* worth quoting—something positively new:

"Actual collision of trains, moving in opposite directions, is a subject scarcely deserving attention; but as there appears a vulgar notion amongst persons who ought to know better, that if two trains meet the shock is proportional to their joint velocity, or to twice the velocity of each train, it may be said the shock sustained by each train is proportional to its velocity; and the same is true as respects each person conveyed by it." !!!

Now, is not this *rich?* Behold some of the fruits of Mr. Curr's notions about "absolute velocity!" Verily and in good sooth he need be such as he describes himself and "his master, Emerson," to be, if they are to undergo personally and practically such collisions on the faith of their theoretical notions about velocity:

"My old master, Emerson, had a clear head—so have I; but he has been laid on the shelf many years—so may I; he loved the truth—so do I; spoke it to his critics—so will I (?); *bowels of gutta percha, heart of leather, brains of fire*—so likewise have I: but this is muttered for their private ear; he hated critics—so do I."

Hear! hear! hear! In no conceivable case, we imagine, could "gutta percha" bowels be so desirable as in so perilous a case. We advise the Gutta Percha Company in their next advertisement to benefit by the suggestion, and insert amongst the other thousand-and-one purposes to which this twistable commodity is applicable: "Very desirable to all those who may experiment on Mr. Curr's notions of velocity, and are disposed to try by an actual smash the correctness of his theory of collision." The "heart of leather," of course, must not be forgotten.

Mr. Curr's notions about the expansion of steam are pretty nearly as original. Of the law of Boyle and Marriotte, established centuries ago, and recently verified by perhaps the most careful series of experiments ever undertaken—viz., by Arago and Dulong, at the request of the French government—he seems entirely ignorant. This law is, that the pressure of steam or any other gas, is proportional to its density, or inversely proportional to the space it occupies—provided only the temperature remain the same. Being in utter ignorance of this, our author once actually fancied that it was promulgated for the first time in page 31, vol. xlvii., *of this Magazine!!!!* Most happy indeed would the writer of the article alluded to (who was not Professor Davies, as Mr. Curr imagines, but another correspondent of the Magazine) no doubt be, to have had the honour of such a discovery. But the law is made use of in the course of the article, as one so well known to everybody, that it would have been impertinent to make any formal allusion to it. Mr. Curr, however, did arrive at the wonderful discovery, that this law (of the proportionality of the pressure to the density) was *not* brought forward a few months since in this Magazine for the first time—and in great glee he adds a note to his book, to proclaim this result of his antiquarian researches. He has actually traced it back to the era 1833, and found it in "The Millwrights' and Engineers' Pocket Companion"—whence Mr. Curr very logically concludes, that "this theory may be taken as a new edition of an error which has been in print for fourteen years." There's a discovery for you! In reward for this unprecedented investigation into

Digitized by Google

antiquity, we will take him back to the year 1662, and, in an old musty book of Robert Boyle, show to his astonished optics the announcement of the law in question as regards air; and then, in every elementary work on physics that has been published from that day to this, point out where he may find the said law explained or referred to —extended to steam and a variety of chemical gases—together with a number of other useful and entertaining facts; at which he will be quite delighted, and to all of which he is evidently as new as the bear was to the pine-apple. We have great fears, however, that all this will be as much thrown away upon him as the fruit was to the quadruped; for has he not proved, "since the particles of steam are of a shape intermediate to the cube and the sphere"—that therefore "the expansive force of steam is as the square root of its expansion"—whatever that may mean. With these very striking and self-excogitated notions, it is no wonder that "although," as he confesses, "with little more knowledge of the science than a dray-horse," he sets to work to promulgate his own ideas as to the thermometer.

From what has preceded, the reader will not be at all surprised to hear that Mr. Curr, being quite innocent of knowing that the point corresponding to Zero on the centigrade scale is marked 32° on Fahrenheit's, fancies he is drawing all sorts of absurdities out of the usual books on the subject of heat; whereas it is from his own unlimited resources in that way that they arise. One sentence will be quite sufficient to show the state of Mr. Curr's acquirements on this matter, and to justify his own assertion, that "he knows no more about it than a dray-horse." "Blood heat by Fahrenheit is 98°, and Boiling water 212°, or as 1 to 2.16. Blood heat by Celsius 36.6°, and Boiling water 100°, or as 1 to 2.73. Therefore, it is evident both scales cannot be correct."

We think we can convince even Mr. Curr —desperate *as* the task may seem—that he is a "*leetle*" obfuscated here. Can he see that the comparison cannot be made, unless from a common starting point? The starting point, viz., the point at which the mercury stands when placed in melting snow, is marked 0 in Celsius, and 32° in Fahrenheit: so that 98° in Fahrenheit is 98°—32°, or 66° above the natural Zero: and therefore Mr. Curr should take the ratio of 66 to 212—32, or 66 to 180, instead of 98 to 212; and he will find, that $\frac{66}{180} = \frac{1}{2.73}$ the same as $\frac{36.6}{100}$ for the thermometer of Celsius, with a slight difference in the last decimal, owing to the actual point of blood heat not being quite accurately marked but only to degrees on the scale. From one thus absolutely unacquainted with the very rudiments of the subject, the reader will easily anticipate what may be expected in the parts where the application of the author's notions is made to steam navigation, &c.

For all the observations we have been making, however, the author seems to be well prepared. With a magnanimous defiance of criticism, he thus eloquently apostrophises all those who may dare to express their opinion of his book:

"But who proclaims himself my critic?—the shadow of a nonentity, whose only knowledge of the subject is derived from the book which he undertakes to criticise: no—it will be left to future ages to find the truth. Man is not to be convinced when truth is in opposition to his interest. Then you will make allowance for the opposition of a host of engineers and iron-masters, who may rise in arms to cry down this book. But the principles are ONE—so break one link of the vinculum, *and down goes my book to the shades below.*"

And there we leave it, as the bishop did Lord Rochester. We cannot conclude this notice, however, without expressing a sincere regret that so much labour and earnest endeavour to obtain knowledge and arrive at the truth, as we believe the author of this work has expended, should have no better result. "The little I have acquired" (and this, we fear, is a *minimum minimorum*,) "has been by unwearied study, often continued without intermission through days and nights; for by such exertion only are

Digitized by Google

Nature's laws to be unveiled." For such a man no generous mind can help feeling the deepest respect, however unsuccessful the effort. The author's case is by no means a solitary one. We have reason to know that there are hundreds of men at this moment—not exiled like Mr. Curr in such distant lands as Australia, but here in England, and in London,—who have wearied themselves for years in labours that *must* end in disappointment; because without any sound and rational foundation.

It is not long since we were favoured with a visit by a person who firmly believed he had solved the problem of squaring the circle, and had come to London to make it known. Without any knowledge of even the elements of Euclid, he had somehow or other arrived, by his own unaided reasoning, at several geometrical theorems, some of which are contained in Euclid, and others not—but which were, in fact, very legitimate deductions. We feel it beyond *our* power to convince such a man of his error, and of the impossibility of the problem he was attempting, by any appeal to principles and processes of which he was quite ignorant; but we have been since agreeably surprised to learn that a mathematician, whose name is well known to our readers, had been able, by reasoning with him in his own way, and on his own grounds, to convince him that he had made a mistake. Now here was time spent and labour thrown away which would have been abundantly sufficient, if properly guided, to have made the man a very decent mathematician. Such cases are far more numerous than would be imagined,—though perhaps not so much in mathematics as in the physical sciences. There is an immense mass of mental power completely thrown away and wasted every year. And such will continue to be the case so long as the present isolation of individual minds amongst the less educated classes exists. It is true that sometimes an original idea is in this way struck out which might never have occurred to one more influenced by the usual routine of study; but even such things never occur in the mathematical sciences, in which every one *must* ascend the steps of the same ladder as his predecessors to a considerable extent, before he can be competent to make any excursions on his own account in fresh directions. If he attempt to cut any such capers before reaching a proper elevation, he is sure to tumble down and break his neck. It is ardently to be hoped, therefore, that some plan may be devised for securing as far as possible, that mental as well as physical energy shall be exerted in a *useful* direction—not meaning by that term to include merely what canting classical sciolists and "*literary*" gentlemen affect to despise, viz., the advancement of our *material* and physical interests—but using the word in its most general sense.

RETROSPECT.—ERRATA ET CORRIGENDA.—BY A. H.

Sir,—My attention has been called by a friend to an oversight in an article of mine, page 107, vol. xlvi., of this Magazine—in which, by a slip, I have written the equation for determining the motion

$$\frac{d^2\theta}{dt^2} - 2m.\frac{d\theta}{dt} + n^2\theta = 0$$

whereas the second term ought to be $+2m\frac{d\theta}{dt}$, instead of with the negative sign. This will give the solution in a different form. I did not consider it necessary at the time to say, that, of course, I did not believe in the possibility of a perpetual motion; but it would have been as well to have mentioned—(as "Pen and Ink" very properly pointed out in the next number,) that if the friction exceeded a certain quantity—the result would be *not* a perpetual motion, but *no* motion at all. As the question is a merely mathematical exercise, I should not have troubled you with this note, were it not that I consider that all such errors should be acknowledged and corrected. The error in the present case, is moreover, one to which the mathematician is very liable to fall, if he be at all careless, and for which he may probably have to pay rather dearly—namely, the getting the wrong sign for a velocity. The angle θ being reckoned from the position of rest of the disc, the linear velocity of any point in it will be proportional to $-\frac{d\theta}{dt}$ and not to $+\frac{d\theta}{dt}$ during the time of its moving towards its natural position. Such slips as these, if

Digitized by Google

not perceived in time, may give rise to cosines instead of sines in integration, velocities destroying each other's effect instead of being added, and, in short, to all sort of mischief.

I will take this opportunity of stating, with regard to the series, entitled, "Use of Mathematics," &c., that they were expressly intended to be merely of the nature of *Hints*, and not as full and copious explanations of the different points alluded to—which would require almost a treatise of itself. There is abundance of room for further explanation and simplification, and I shall consider the utility of what has been written considerably increased if it induces such of your correspondents as Mr. Williams and Mr. Orley to go still further into the matter.

In common with many other of your readers, I shall be glad to see the commencement of the "Miscellanea Mechanica." Although but little novelty can be expected in such a subject—the ground having been trodden for centuries by some of the greatest men who have ever lived—there is yet room for every thinking reader to contribute in some degree to the progress of the learner: and even to those who are already acquainted with the subject, it is not without interest to see the mode in which others view it. In short, there is a need of something like a *Students'* mathematical journal; for it is unnecessary to say, that such ones as the "Cambridge Mathematical Journal," &c., are utterly useless to him. The Diary, too, is confined to problems, and appears but once a year. There is, therefore, actually what the newspapers call a "desideratum," I feel tolerably certain, that a great number of isolated and unassisted students would feel extremely thankful for such aid, and, on the other hand, I do not think there would be wanting those willing to lend them a hand.

Every mathematician *who deserves* the name, and who cultivates it, not for the sake merely of making books or getting money—*but for the love of the thing itself*—every such a one must wish for the progress of that science, and be anxious to enlist into its service all who are able and willing to enter. I have no hesitation in saying, that I believe there are far more such men *out* of the universities than in them—men scattered up and down—who labour, and think for the sake of thinking. I say this, from some personal knowledge of the fact; and I may quote the authority of Professor De Morgan, as additional evidence. "As it is, however, the few in this country who pay attention to any difficulty of mathematics for its own sake, come to their pursuit through the casualties of taste or circumstances," &c.—(Preface to Differential and Integral Calculus.)

I am, Sir, yours, &c.,

A. H.

P.S. The following errata in the series on "The use of Mathematics, &c.," require to be corrected, as in some cases altering the sense, or making nonsense. Page 372, vol. 46, col. 1, line 12, for "$k=o$," read "$x=o$," and next line read—"and then comes down upon you with the Q. E. D.;" line 34, for "naturally," read "rationally;" and line 43, read—"to be had in part;" page 396, col. 1, for "Rise and abuse," read "Use and abuse;" page 425, col. 1, for "practical," read "practised." The accidental transposition of a paragraph from one column to another, in page 32 of the present volume, must also be rectified before any sense can be made of that article.

DETERMINATION OF THE LONGITUDE BY THE MAGNETIC TELEGRAPH.

[From a New York paper, as quoted in the *Athenæum*.]

The observations at the Washington Observatory were made by Professor Keith; those at Philadelphia by Mr. S. C. Walker; and those at Jersey City by Professor Loomis. These three observatories were connected by a continuous wire; so that telegraphic signals might be exchanged between any two of them at pleasure. In some of the first experiments, signals were exchanged between Jersey City and Philadelphia, and also between Philadelphia and Washington; but it was found impossible to transmit signals directly from Jersey City to Washington. The power of the battery appeared inadequate to that distance. But on the 29th of July this difficulty was overcome. Twenty clock signals were given at Jersey City, and recorded both at Philadelphia and Washington; twenty signals were given at Philadelphia which were received at Jersey City and Washington; and twenty signals given at Washington were received at Jersey City and Philadelphia. Thus the comparison of the three clocks was perfect; and thus the original plan of observation was fully carried out. This was glorious success, and enough to repay the observers for all their past disappointments. The same complete set of signals has since been again exchanged between the three observatories. The object of the observations has thus been completely attained.

The difference of longitude between Jersey City and Philadelphia, is *four minutes and thirty seconds*; and between Jersey City and Washington, *twelve minutes and three seconds*; omitting in each case a fraction of

Digitized by Google

a second which can only be fully determined when all the observations have been completely reduced.

It is not uncommon to hear doubts expressed respecting the enormous velocity which is ascribed to the transmission of telegraphic signals. The experiments just noticed afford some information upon this point. They furnish the means of measuring the velocity of the electric fluid; provided the time employed in its passage from Jersey City to Washington, is not too small to be appreciated. Suppose the difference of longitude between the two places is exactly twelve minutes. Accordingly, when it is ten o'clock at Washington, it will be twelve minutes past ten at Jersey City. Let now a telegraphic signal be given from Jersey City. If that signal is heard at the same instant at Washington, then the Washington clock should indicate exactly ten hours. But if it requires one second for the signal to travel to Washington, then upon its arrival the Washington clock will indicate ten hours and one second; that is, according to this comparison, the difference between the Jersey City and Washington clocks will appear to be *eleven minutes and fifty-nine seconds*. Suppose again, that at ten o'clock a signal is given from Washington. If that signal is heard at the same instant at Jersey City, then the Jersey City clock should indicate exactly twelve minutes past ten; but if it requires one second for the signal to travel from Washington to Jersey City, then upon its arrival the Jersey City clock should indicate ten hours, twelve minutes, and one second; that is, according to this comparison, the difference between the two clocks appears to be *twelve minutes and one second*. The two comparisons differ by *two seconds*, or twice the time required for the signal to travel from Jersey City to Washington. Now, whatever may be the time required for the transmission of a signal, the difference between the two modes of comparing the clocks should amount to *twice* that interval, and the longitude derived from signals transmitted from Jersey City to Washington should be *less* than that derived from signals transmitted from Washington to Jersey City.

What now is the result of the experiments actually made? The longitude derived from the two modes of comparing the clocks do really differ. The difference amounts in some cases to one-third of a second. But, strange as it may appear, this difference is in the wrong direction. The longitude derived from signals transmitted from Jersey City to Washington is greater than that derived from signals transmitted from Washington to Jersey City. The conclusion seems to follow, that a telegraphic signal is transmitted more than two hundred miles in less than no time. Observe that we now speak of absolute, not local time; for it is not doubted that a signal made at Jersey City at ten o'clock will reach Washington long before ten according to Washington time. But the observations seem to indicate that a signal from Jersey City is heard at Washington before it is made at Jersey City; and also that a signal from Washington is heard at Jersey City before it is made at Washington. Such a conclusion will suit poetry better than science. It seems probable that the difference in question arises from the difficulty of estimating minute fractions of a second. This is indicated by the fact that, on one evening, the Jersey City and Philadelphia clocks were found to tick together; and the signals being given coincident with the beats of one clock, the times of arrival coincided with the beats of the other clock. Thus there was no fraction of a second for the ear to estimate, and the two modes of comparing the clocks gave identical results. On several evenings the discrepancy in the observations amounted to about *one-third of a second*; and if we suppose each observer to err in his estimate by *one-sixth of a second*, the difference is explained; only we must admit that each observer, upon the arrival of a clock signal, estimates the time one-sixth of a second *too soon*; which *seems* to indicate that the signal is heard at a distant station before it is really made.

That this hypothesis is not without foundation has been verified in the following manner: — The three observers, Messrs. Loomis, Walker, and Keith, have met at Jersey City, and compared their methods of observation; more especially their modes of estimating fractions of a second. This was done by comparing solar time with sidereal time. The solar day is about four minutes longer than the sidereal; and a sidereal clock will therefore gain upon a solar clock, one second in about six minutes. A series of signals was transmitted from Jersey City to Philadelphia, at intervals of ten seconds; coincident with the beats of a solar clock, and the times recorded by Professor Kendall at Philadelphia upon a sidereal clock. The times were also recorded at Jersey City by a sidereal clock. These signals were continued for ten minutes, during which time the sidereal clock had gained more than one second upon the solar. The signals being all given coincident with the beats of a solar clock, the fractions of a second estimated upon the sidereal clock go on continually increasing, and pass through every possible value in about six minutes. In a period of ten mi-

Digitized by Google

nutes, the clock-beats must twice coincide. Now the ear can judge of a *coincidence* of beats with almost absolute precision; and having determined the instants when the beats coincide, we can easily compute what fraction ought to have been estimated upon the sidereal clock at each signal from the solar clock. Thus we obtain the error of each estimate of time on the sidereal clock. A similar set of signals was given at Philadelphia from a solar clock, and received at Jersey City upon a sidereal clock. The result of these trials was to detect a small error in the estimation of fractions of a second; and such as will explain in part, if not wholly, the discrepancy of the observations.

One important conclusion is deducible from these experiments, viz., that by means of the magnetic telegraph, *a clock in New York can be compared with another at a distance of two hundred miles quite as accurately as two clocks can be compared in adjoining rooms.* Another conclusion which appears to be authorized by these experiments is, that *the time required for the electric fluid to travel from New York to Washington and back again, a distance of 450 miles, is so small a fraction of a second, that it is inappreciable to the most practised observer.*

THE CRICKET STEAM-BOAT EXPLOSION.—THE VERDICT.

The Inquest Jury returned, late on Friday (24th,) after our Number for last week had gone to press, the following verdict:

"We find that Thomas Shed, John Littleton, John Blunt, George Shute, and John Buckley, came to their deaths through the bursting of the boiler of the *Cricket* steam-boat, on the 27th of August, 1847. We find a verdict of manslaughter against Henry Robert Heasman. We consider Thomas Clark highly culpable, and unfit to hold a situation of engineer. We likewise consider Mr. Smith's conduct shamefully neglectful in not properly investigating the complaint made against Clark."

Heasman, who has been found guilty of manslaughter, is the engineer who was in actual charge of the *Cricket* on the morning of the explosion; Clark was the general engineering superintendent of the A. B. C. Company's boats.

ADCOCK'S SPRAY PUMP.

Sir,—A correspondent, who signs himself "Cassell Morlais," writes on the subject of Mr. Adcock's Spray Pump; and he dates his letter from Merthyr Tydvil, one of the largest sites of the iron manufacture.

Now, Sir, I wish to know whether he be acquainted with the processes of the iron manufacture; and with blast cylinders? If so, he must, for some object best known to himself, have written his letter expressly with the view to deceive your readers.

He informs us, that Mr. Adcock employs a blast cylinder 48½ inches diameter; and then states, that such cylinder is equal to 54 horses power!!!

Is "Cassell Morlais" aware that it is always customary in the iron trade to make the blast cylinder twice the diameter of the steam cylinder? A 48-inch blast cylinder, therefore, would take a 24-inch steam cylinder! And is "Cassell Morlais" aware, that a 24-inch steam cylinder is 20 horses power? How, then, does he make it 54 horses power?

The fact is, Sir, the very blast cylinder now working at Llanhithel was worked, in this neighbourhood, to 4lbs. pressure, by a 28-inch low-pressure condensing engine,—which is not half the power stated by "Cassell Morlais;" and as the engine had been employed as an old "*Whimsy*," to wind up coal from a pit, it did not work to the power that an engine of that sized steam-cylinder should do.

I know nothing of "Cassell Morlais's" other figures; but in the one under consideration, there is an error of nearly three to one. I am, Sir, yours, &c.,

"FAIR PLAY."

Birmingham, Sept. 16, 1847.

[We have reason to suspect we have been made, unconsciously, the instruments of a wicked conspiracy to depreciate Mr. Adcock's invention by the publication of *wilfully* erroneous statements which have been sent to us with names and addresses having all the appearance of reality, but which are, in truth, entirely fictitious. Who, for instance, is the "J. Phillips" who last addressed us on this subject from "Greenwich?" No such person is known at the Greenwich post-office. ED. M. M.]

Mr. Stephenson's Long-bodied Locomotives.

The inquest on the body of the engine-driver, Gregory, who was killed last summer on the London and Brighton Railway, by the running of the engine he was driving off the rails, has been only this week concluded. The verdict is in the following terms:

"That Samuel Gregory, on the 31st of May last, was killed by the engine No. 40 running off the line of the London, Brighton, and South Coast Railway, in the parish of Westbourne, in this county; that such engine was subject to considerable oscillation, which gave it an undulating, swaying, and jumping motion, but whether the engine left the rails in consequence of such motion, or from what other reason, no evidence appears to us."

Captain Allen (the foreman).—In addition to this verdict, the jury also wish to recommend to the Directors of the London, Brighton, and South Coast Railway, that they should not in future use this description of carriage upon the railway.

Mr. Faithful.—These engines are now no longer used for passenger trains. (Hear, hear.)

A Juryman.—The public will be glad to hear it.

Digitized by Google

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 & 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Sep. 30	1211	Foster, Porter, & Co.	Wood-street, Cheapside	Cravat.
Oct. 1	1212	Richard Holland and William Turner	Sheffield	File.
4	1213	John Johnson	Leicester	Waistcoat-band or strap.
,,	1214	John Froggatt	Lenton, Nottingham, manufacturing chemist	Improved dropping dibble.
5	1215	Smith, Beard, & Co.	Cheapside	Fastening for shirt-collars, &c.
6	1216	John Slate	Wandsworth	Pneumatic chimney-top, and smoke-spreader.
,,	1217	Henry Doulton	Lambeth	Egg-shaped sewer.

Advertisements.

Cunningham & Carter's Pneumatic Railway System.

Description.

THE SYSTEM OF PROPULSION, now submitted to the notice of the Public, differs essentially from all the plans hitherto tried or proposed, and is considered to be WHOLLY FREE from the PRACTICAL DIFFICULTIES which have so seriously retarded the application of atmospheric power.

The carriages run upon lines of rails, constructed and laid down as usual, but their propulsion is effected through the medium of rails, attached to the sides of the carriages, which derive their motive force from being brought into contact with the peripheries of a succession of revolving horizontal wheels, placed in sets of three each, at distances of about 300 feet apart—one wheel being placed outside of each line, and the third in the space between the two lines—all three being connected and put simultaneously in action by air-engines, suitably mounted; these communicate with an atmospheric main, common to the whole series of engines, laid down outside the rails, beneath the surface of the ground.

The shafts of the three horizontal wheels revolve in proper bearings, within an iron case, fixed in a trench beneath the rails, and extending transversely into the banks. The case being made in sections, can be laid down with great facility: it protects the inclosed machinery from injury, from wet or dust, or interference—while access may be readily had to the interior, for the purposes of inspection or repair.

The propelling wheels are themselves all above the ground.

Among the numerous ADVANTAGES arising from this arrangement, the following may be stated:

The PROPELLING WHEELS being above the rails, no alteration will be required in the rails or carriages, as now constructed.

The PRIME MOVERS, or STATIONARY ENGINES, may be situated wherever fuel is cheap, or water power exists; and, as they all work into the main tube, no delay to the traffic can occur through the derangement of either of them.

POWER being always in readiness, TRAINS may follow each other in rapid succession—while their starting may be so regulated, independent of the drivers or guards, that it shall be impossible for one train to overtake, or come in collision with, another.

As the number of revolutions of the propelling wheels, and the degree of adhesion of the same, may both, or either of them, be increased or diminished at pleasure, independently of the prime movers, an engine, or engines, will be capable of a greater range than at present.

By this system any kind of work can be performed, as the engines work equally well each way.

No unpleasant effects from gas, steam, or cinders.

Perfect safety secured, by fixed and self-acting arrangements, out of the reach of interference, and entirely independent of attendants.

Great economy in the formation of new lines, from reduced weight of rails and general cost of works, where no locomotive engine is used.

Great economy in the working expenses, arising from the use of stationary power, and the small amount of deterioration of the works generally.

DAILY EXPENCE OF WORKING A DOUBLE LINE.

Of FIFTY MILES long, during a period of 18 hours, with trains starting from each terminus every half hour.

Six Trains always Running.

Coals for five stationary engines, of a 100-horse power each, at 5 lbs. per horse-power—say, 11 tons, at 14*s.* per ton		£7	14 0
Wages—			
Engine-men, with relief, 10 at 6*s.*	£3 0 0		
Stokers, with relief, 10 at 4*s*	2 0 0		
Cleaners, with relief, 10 at 2*s.* 6*d.*	1 5 0		
Drivers, with relief, 12 at 5*s.*	3 0 0		
Guards, with relief, 12 at 5*s.*	3 0 0		
Twenty men, stationed along the line, at 3*s.*	3 0 0		
		15	5 0
Repairs of engines, with depreciation, &c., at £200 each per annum, multiplied by 5 = £1,000—daily proportion		2	15 0
Contingencies		4	6 0
Total		£30	0 0

Forty trains, at 15*s.* per train, £30, being a fraction more than 3*d.* per train per mile.

Parties desirous of viewing the model, or receiving further information, will be immediately attended to, by addressing Mr. Cunningham, at the Auction Mart Coffee-house, Bartholomew-lane, London; or Mr. Carter, Engineer, Peak-hill, Sydenham.

Gutta Percha.

September 1, 1847.

THE GUTTA PERCHA COMPANY, in requesting the attention of the Public to the accompanying Testimonials, have great pleasure in stating that the steadily increasing demand for the PATENT GUTTA PERCHA DRIVING BANDS justifies the utmost confidence that they are fully approved.

Their durability and strength, permanent contractility and uniformity of substance—their insusceptibility of injury from contact with Oils, Grease, Acids, Alkalies, or Water, and the facility with which the single joint required can be made in Bands of an indefinite length, render them superior

Digitized by Google

for almost all working purposes, and decidedly economical.

Haslingden, September 4, 1847.

Dear Sir,—We have now been using the Gutta Percha Straps for the last eight months, and have great pleasure in saying they have answered our most sanguine expectations; and we may add, that some of our machines which required a 12-inch leather strap, and which almost daily required to be repaired, we have been turning the same with the Gutta Percha Straps 10 inches only for the above-named period, and now find them as good as the day they were first applied.

We remain, yours respectfully,
W. & R. TURNER.

To S. Statham, Esq., Gutta Percha Company.

Atlas Works, Manchester, Sept. 1, 1847.

Sir,—In reply to your inquiry as to the result of our experience with the Gutta Percha Straps, we have great pleasure in stating that the advantages they possess are so very manifest as to induce us to apply them in almost every instance where new straps are required.

We are, Sir, very respectfully,
SHARP, BROTHERS.

Samuel Statham, Esq., Gutta Percha Company.

Bridgewater Foundry, Patricroft, near Manchester, Sept. 3, 1847.

Sir,—In reply to your inquiry respecting how we like your Gutta Percha Machine Straps or Driving Belts, although we have not had quite so much experience in the above-named use of Gutta Percha as we hope to have, so far as we have employed it, it has given us general satisfaction. The beautifully straight and regular manner in which it runs on the pulleys, especially on our cone or speed pulleys, is a strong recommendation in its favour; and although we are inclined to think it does not take so fast a grip on the pulley as leather, yet there is ample hold for all general purposes. We shall continue to use it and to give it our best attention, so as to learn how to employ to best advantage the many excellent qualities it possesses over the ordinary leather belts.

NASMYTH, GASKELL, & CO.

S. Statham, Esq., Gutta Percha Works, London.

Manchester, 18th June, 1847.

Dear Sir,—We beg to inform you that we have now had the patent Gutta Percha Bands or Straps in use for more than six months. For tube frames we consider them very much superior to anything we have tried before. They also do very well as open straps for mules, throstles, looms, &c.

We are, Sir, yours respectfully,
THOS. DODGSHON & NEPHEWS.

Mr. Samuel Statham, Gutta Percha Company.

Wellington Mills, Stockport, 4th September, 1847.

Gentlemen,—We have much pleasure in bearing our testimony to the valuable qualities of the Gutta Percha for driving bands. We have found it answer exceedingly well in most cases where we have tried it, and we think it has only to be made known to ensure its very general use.

We are, Gentlemen, yours obediently,
HOLB, LINGARD, & CRUTTENDEN.

To the Gutta Percha Company,
City Road, London.

Tottington Hall, near Bury, Lancashire, September 3, 1847.

Dear Sir,—Your letter of the 31st August is to hand, and in answer respecting the use of your Gutta Percha Bands, I cannot give you a better proof of our approval of them in preference to leather straps than having given an order for another to your partner, yesterday, to be in readiness in case of accident. They are decidedly preferable to the old straps; and we can recommend them with the greatest confidence to any person for Driving Straps.

For HALL & GORTON, THOMAS GORTON.

S. Statham, Esq., Gutta Percha Company.

Brewery, 16th September, 1847.

Gentlemen,—We have much pleasure in repeating our testimony to the very great improvement effected by the use of Machinery Bands made of your material instead of leather: the stoppage of parts of our works, through the failing of the leather straps, used to be of daily occurrence, causing great inconvenience and expense. With this annoyance we are now never troubled, and are assured by our superintendent that the advantage of using your material is surprising, as regards economy and saving of trouble. We confidently recommend it to machinists and factories for general adoption.

TRUMAN, HANBURY, BUXTON, & CO.

To the Gutta Percha Company.

Gutta Percha Soles for Boots and Shoes.

The capabilities of the GUTTA PERCHA SOLES FOR BOOTS AND SHOES having been extensively and satisfactorily tested, we can unhesitatingly recommend the material prepared for the purpose, its merit having been acknowledged by all who have worn it. Indeed, experience has proved that Gutta Percha Soles wear twice as long as leather, with great additional personal comfort, and they remain perfectly impervious to wet until quite worn through.

23, Southampton Row, 1st Sept., 1847.

Gentlemen,—I write to thank you for allowing me to use the new PATENT GUTTA PERCHA SOLES. I felt annoyed at not being allowed to use them from the time I had first worn them, namely, from last October, but am not sorry now, because I can speak confidently of their advantages over leather soles. I made the first pair last October, and wore them eight months before I wore the soles through. I had them heeled six times, and one pair of extra fronts I put to the same soles. *I only kept the one pair in wear to see how long they would last.* I will never wear another leather sole so long as I can get GUTTA PERCHA SOLES, and I walk from 12 to 20 miles a day.

C. WRIGHT, Boot and Shoe-maker.

To the Gutta Percha Company.

9, Gloucester Row, Hoxton, 5th July, 1847.

Sir,—I beg to thank you for the boots with GUTTA PERCHA SOLES which I had from you on the first of the year. I have had them in constant use for nearly five months, the greater portion of that time being the most inclement period of the year; and from my occupation as a general post letter-carrier, you may be sure that they have had more than a common fair trial, and the Gutta Percha seems now as firm and as little worn as on the first day.

W. HUTTON, G. P. O. Letter Carrier.

To E. Granville, Esq., Gutta Percha Works.

28, St. John-street, August 25th, 1847.

Gentlemen,—It gives me great pleasure to acquaint you that the Gutta Percha Soles I had from your Works have answered the purpose admirably, as I can fully testify, having had them in wear six months, during the winter, in Smithfield-market, and have not been subjected to the annoyance of wet feet, as is often the case with leather soles, and, in my opinion, they wear three times as long.

H. I. TARLING.

To the Gutta Percha Company.

N.B.—The above Soles, which are not worn out, may be seen at the Gutta Percha Company's works.

Galoshes, Tubing of all sizes, Bougies, Catheters, and other SURGICAL INSTRUMENTS; MOULDINGS FOR PICTURE-FRAMES and other decorative purposes, WHIPS and THONGS, TENNIS, GOLF, and CRICKET BALLS, are in a forward state of manufacture, and will be very shortly ready for sale.

All orders forwarded to the COMPANY'S WORKS, WHARF-ROAD, CITY-ROAD, will receive immediate attention.

Digitized by Google

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3d.; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Mechanics' Magazine.

STAMPED EDITION.

TO meet the numerous demands for the earliest possible Copies of this Journal, a Stamped Edition to go by post, price 4d., will be commenced on the 6th November next. It will be published every Friday, at 4 o'clock, p.m., precisely, and contain the New Patents sealed, and Articles of Utility registered during each week, up to the time of going to press. Subscribers are requested to give their orders as early as possible. Subscriptions to be paid in advance. Per annum 17*s.* 4*d.*, half-yearly 8*s.* 8*d.*, quarterly 4*s.* 4*d.*

"The MECHANICS' MAGAZINE has conferred lasting advantages on the manufactures of the country."—*Report of Select Committee of the House of Commons on the Arts of Design.*

Messrs. Robertson and Co., Patent and Registration Solicitors, 166, Fleet-street, (*Mechanics' Magazine*-office.) Supplied by all Booksellers and Newsmen.

Professor Davies's "Law of Atmospheric Resistance." *Errata.*—Page 410, col. 2, line 17, for *e* read *x*; line 38, for *its* read *the*.

CONTENTS OF THIS NUMBER.

Dr. Jager's Patent Improvements in Fire-arms and Cartridges—(*with engravings*) 419
On Elimination in Linear Equations. By Professor Young 424
Short Methods in Gauging. By Mr. Witford... 426
Ellerman's Patent Deodorizing and Disinfecting Processes 427
How to raise the Britannia Tubular Bridge... 428
On Yacht Sailing. By Captain Shuldham, R.N. 429
Cast-iron Girder Bridges. By A. H. 430
Glover's Patent Improvements in Warp Net Fabrics—(*with engraving*) 430
Short Method of Determining the Slopes for Railway Cuttings. By Mr. George Korbes —(*with engravings*) 430
Railways.—The Question of Railway Friction Considered in Respect to the Drawing and Drawn Carriages..... 432
Chapters on Analytical Geometry. By James Cockle, Esq., M.A., Barrister-at-law.—Chap. VII. The Elliptic Paraboloid, &c. 433
On the Employment of Heat as a Motive Power. By A. H. 434
The Mathematics of Phrenology.—General Tom Thumb 434
The Leather Trade of the United States..... 435
"Solutions of Trigonometrical Questions." By Thomas Gaskin, M.A.—(Revi·w)..... 436
Curr's Railway Locomotion and Steam Navigation 438
List of Scotch Patents 439
Weekly List of New English Patents..... 439
Weekly List of Articles of Utility Registered 439
Advertisements 440

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 165, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh

Digitized by Google

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1265.] SATURDAY, NOVEMBER 6. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166 Fleet-street.

SIMPSON'S SUBMERGED HORIZONTAL SIDE-PROPELLERS.

Fig. 1.

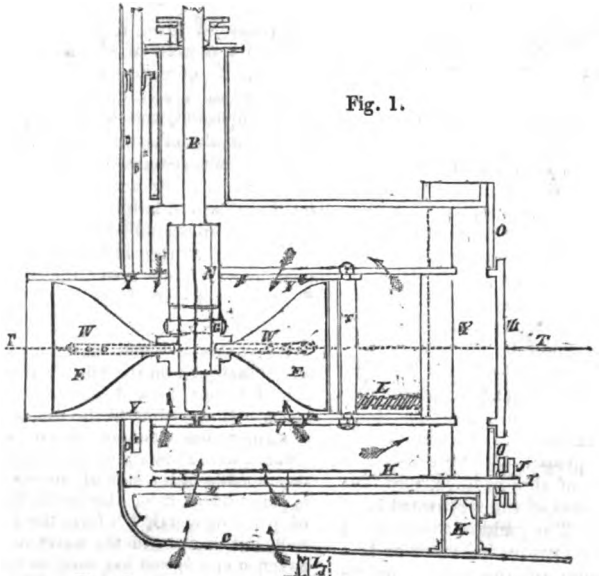
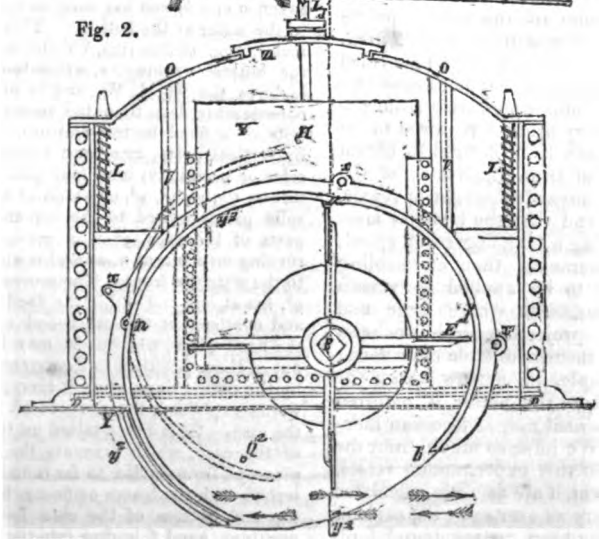


Fig. 2.



Digitized by Google

SIMPSON'S SUBMERGED HORIZONTAL SIDE-PROPELLERS.

[Patent dated September 25, 1846. Specification enrolled March 25, 1847.]

On Saturday last a small steamboat, called the *Albion*, fitted with invisible, or submerged horizontal side-propellers, on the plan patented by Mr. T. B. Simpson, made her first experimental trip down the river. The boat is 90 feet long, and of 10 feet beam; the engines are of 10-horse power, and built by Messrs. Christie, Adams, and Co.

Several plans of horizontal side-propelling have been before proposed; one by the present patentee himself in connection with another party, which was described in our 43rd vol., p. 433. The one now before us is distinguished from its predecessors in three important particulars. *First*, The wheel-case is made of such a shape and construction, and the paddles are set in such a position, that as the wheel revolves it produces a strong current of water directly sternwards, or in a direction parallel to the line of the vessel's course. Something like this has been done by submerged propellers before, but not, we think, to the same extent. The result is a combination of two forces to propel the vessel — the direct leverage of the paddles, and the retro-active thrust of the sternward current. *Second*, The paddles are so fixed that they may be protruded more or less beyond the side of the vessel, or be brought flush therewith. And, *Third*, the case is made moveable, and provided with such appliances that both case and wheel may be shut up entirely from the water when they are not required to be in use, or when it is desired to obtain access to them from the inside of the vessel for purposes of inspection or repair.

We apprehend that the inventor aims less at obtaining a high degree of speed, by his arrangements, than at enabling steam power to be applied to vessels under circumstances where large and permanently projecting paddle-wheels and cases are insurmountable objections; as, for example, in narrow rivers or canals, or where the power is required only for occasional use, as in ocean merchantmen. We infer so much from the form given to this experimental vessel, the lines of which are as little calculated for speed as any we ever saw; but perhaps that may have been an accidental fault of construction.

The distance between the Brunswick-pier Blackwall, and Erith, stated to be 12½ miles, was performed on this experimental trip in 1 hour, 11 minutes. Not a great speed this, contrasted with that of a paddle-wheel vessel (the *Courier*), whose trial-performances are recorded in our present Number; but still a degree of speed highly satisfactory, if considered in combination with the other advantages with which it is accompanied, and which are peculiar to this mode of construction. Not the slightest surface-swell was perceptible; neither was there any of that vibration on board which is felt more or less in all other steam-propelled vessels.

We extract the following descriptive particulars, and also the illustrative figures prefixed, from Mr. Simpson's specification:

Fig. 1 is a sectional elevation, and fig. 2 a sectional plan on the lines, TT, of one of a pair of wheels, formed, constructed, placed, and fitted, according to the said plan. K, is a strong basement of metal or wood, secured to the bottom of the vessel. Y, is a recess made in the side of the vessel, which is partitioned off on the inside by a casing of wood or metal, Y^2, from the rest of the hull, but is open to the water in front between *a* and *b*, and has also an opening, *c*, to the water at the bottom. Y^2 is a case of metal, supported on ribs, VV, thrown athwart the bottom opening, *c*, which immediately incloses the wheel, W, and is of an area considerably less than the recess: it consists of a fixed bottom and top, connected by vertical posts, *xxx*, and divided on the sides or periphery, into four parts or segments, y^1, y^2, y^3, y^4, of which y^1 and y^2 are solid pieces united to the top and bottom parts of the case, y^2 is a moveable piece turning on a pin at *n*, and y^4 is wholly open to the water in front. The moveable piece, y^3, fits at one end within the fixed piece, y^2, and overlaps at the other end one end of the fixed piece, y^1; but it may be moved out of these positions to the extent indicated by the dotted lines, when it serves, as afterwards explained, the purpose of a valve to the case. Q^2 is a stop raised on the bottom of the case, which prevents the moveable piece, y^3, frommoving so far round as to interfere with the leaves or floats, E E. The top and bottom of the case have central openings, *e* and *f*, leading into the interior of the wheel, the former, *e*, corresponding with

Digitized by Google

the bottom opening, *c*, of the recess. The shaft of the wheel is stepped at bottom in a cross-piece, M, secured to the bottom of the wheel-case, (in the reverse direction of the ribs, VV,) and connected at top to the driving shaft, B (which passes through a stuffing-box, A) by means of a coupling-box, N, and key G. The wheel-case has two horizontal screws, LL, attached to the back of it, and worked from within the vessel, by means of which it may be moved forwards or backwards on its supporting ribs, VV, and the wheel may be also moved along with it, (being uncoupled for the time from the driving-shaft, B). The wheel and case may be protruded to any extent not exceeding the greatest diameter of the case, and to whatever extent within such limit they are protruded the case must fit exactly the front opening of the recess, (as exemplified in figs. 1 and 2.) The greater size of the recess admits of both the wheel and case being wholly withdrawn within the recess. Previous to setting the wheel to work, the recess and wheel-case are entirely filled with water through the front top and bottom openings, but a motion being given to the wheel (say from right to left) the water is driven out by the centrifugal action of the leaves, or floats, EE, through the front openings in the recess and wheel-case, while a continuous supply of other water to the interior of the wheel is kept up, by the in flow through the top and bottom openings, *c*, *e*, *f*, as indicated by the arrows. But as it is desirable that the water should be driven out in a direction more sternward than could be effected by the centrifugal action of the leaves or floats alone, this is accomplished by making the forward part, y^4, of the wheel-case project beyond the side of the vessel to a much greater extent than the hinder-part, y^1, (as shown in fig. 2,) which causes a forcible yet gradual deflection of the water in the desired direction. And in order that there may at the same time be an open and free course for the ejected water, the wheel-case is more or less enlarged forward. In fig. 2 this enlargement is exemplified as carried out to the largest extent which I should deem advisable; but I do not limit myself to any particular degree of enlargement, as that would necessarily vary with the dimensions, form, and position of the leaves or floats employed. And the more effectually to secure a free egress for the water, the leaves or floats may be made to turn on their edges while passing round the back part of the case, which may be effected by any of the approved and well-known methods of causing paddle-wheel floats to feather or turn on edge.

When it is desired to back the vessel, this is done in the usual way, by reversing the motion of the driving-shaft; but it being expedient in that case to diminish the open space forward in the wheel-case, and to prevent any inflow of water from the outside at the forward end, this is effected by means of the moveable or valvular piece, y^3, before mentioned. The current of water, as long as it is flowing in the direction of the arrows, presses the outer end of the piece, y^3, up against and flush with the inside of the part y^2, of the wheel-case; but immediately on the current being reversed, it turns the piece, y^3, into the position indicated by the dotted lines. When it is desired to suspend for a time the employment of the wheels—as, for example, when they are employed as auxiliaries merely, and recourse is had to the sails alone, or when it is desired to get conveniently at the wheels for the purpose of inspection or repair—the cases and wheels may be drawn back within the recesses by the screws, LL, as before mentioned (the wheel-shaft being uncoupled for the time from the driving-shaft,) and wholly shut off from the water, and thrown open to access from the inside of the vessel by means of the following additional arrangements:—D, is a vertical piece of metal, which is let into the side of the vessel immediately above the wheel-recess, and D^a, a slide, which fits into a groove made in this metal-piece, and is raised or lowered by means of a chain weight, and pulley (not shown in the figures,) or any other suitable means. On the withdrawal, as aforesaid, of the wheel-case and wheel, and dropping the slide, D^a, it falls into a corresponding groove made for its reception in another metal-piece, D^2, fitted into the side of the vessel immediately beneath the wheel recess, and that recess is thereby closed against the water in front. The bottom opening is closed in like manner by means of a horizontal slide, H, which moves in an opening made for it in the bottom casing of the wheel recess, and is pushed forward or drawn back by means of a screw-shaft, I, acted upon from within the vessel, which passes through a stuffing-box, J. When the wheel recess has been thus closed in by the two slides, D^a and H, the water may be pumped out of it, or run into the bilge, and a water-tight door, Z, formed in the back part, OO, of the recess, may be then opened to give admission from the inside of the vessel.

R, is an air-vent tube, with a stop-cock or valve, which may be carried to any height, or in any direction found most convenient.

Mr. Simpson has deviated somewhat from the plan thus set forth in his specification in the construction of the *Albion*, but the extent to which he has done so

Digitized by Google

we must reserve for explanation in our next.

ON THE EMPLOYMENT OF HEAT AS A MOTIVE POWER. BY A. H.

(Continued from page 405.)

The rationale of the facts of specific and latent heat is the same; in both the same mechanical law is involved. The non-communication of motion to the mercury in the one, and the different degrees of such communication, according to the substance with which it is in contact, in the other, are of the same nature as the difference between the specific heat of a gas under constant pressure and constant volume; the reason of which has already been given. All of these various effects are but instances of the general mechanical fact, that in a machine composed of different parts, or indeed in any compound system of particles whatever, if one portion of the machine or system be free to move in obedience to the moving force, it will absorb in so doing, that which would have been communicated to other, portions if it had been fixed. With regard to the specific heat of different bodies, that is, the different degrees of dilatation of the mercury in contact with them, when a given amount of heat is supplied, the cause of this lies in the different degrees of resistance between the contiguous particles of the substance. The greater the resistance, of course the greater the reaction against the mercury, and consequently the greater the expansion of that mercury. If the particles of the substance experimented on be ready to yield easily,—that is, if the mutual cohesive force be small, the motive power of the heat is employed in *dilating* the substance, and therefore there is the less of it for the mercury; whereas if the molecular resistance of the substance were greater, there would be a proportionally greater amount of pressure or re-action against the mercury available for producing motion or expansion in it. It is for this reason that in the last paper I said, that, probably the specific heats of all substances are the same if sufficient external pressure be exerted to keep them under a constant volume, *i. e.*, to prevent their expanding.

Now with regard to latent heat, the same reasoning is obviously applicable. The resistance to expansion in the particles of the water in which the thermometer is immersed, becomes less and less, and therefore there is a continually diminishing re-action against the mercury. But through a considerable range of temperature this diminution is very gradual and small: when, however, the point of ebullition is approached, this resistance, and the consequent pressure against the mercury diminishes with extreme rapidity, and at length disappears altogether, leaving the thermometer stationary.

Let us now return to the subject of specific heat, for the purpose of examining the various circumstances affecting it. It will be observed that Dulong and Petit's Table contains only what are called "simple or elementary substances." As the very name implies, therefore, we have in such substances no indication of any other effect being produced by the heat besides the expansion of the substance: I mean we have no *chemical action*, no resolution of compound particles into simpler ones, nor any appreciable tendency towards such an effect. If now we go on to experiment upon those substances which we know to consist of compound particles, our reasoning must be qualified accordingly. The *tendency* to chemical decomposition must be taken account of, and measured in the same way as the tendency of water to pass into steam: there will be a latent heat from the one as well as from the other cause. Take, for instance, the oxide of a metal, MO; not only will the heat be employed in separating one particle of the *oxide*, MO, from another particle of the same kind, but also in separating the M in any one compound particle from the O in that same particle. We cannot therefore compare *directly* the work done in two such different cases as those of a simple and more compound substance. The ratio of the specific heats will not therefore necessarily follow the same law as those of *similarly* constituted bodies. The specific heat, for example, of oxide of copper will not bear to that of a simple substance, such as iron, the inverse ratio of their atomic weights. But if we take two compound bodies of similar atomic constitution, then there is more probability of *their* specific heat, being inversely as *their* atomic weights. This is precisely the characteristic law of the recent experiments of Regnault. His researches have been extended to a very

Digitized by Google

great variety of bodies—the results may be found tabulated in Pouillet's *Elements de Physique*, fourth edition, tome ii., pp. 511—517. So far as the simpler bodies are concerned, these recent results are confirmatory of those obtained by Dulong and Petit. To give an idea of the results, I shall copy a few:

The product of the specific heat by the atomic weight for the same class of substances as those comprised in Dulong and Petit's Table, averages about the number 40, the least being 37.849, and the highest .42.7. (Bismuth, however, is 45.034.) The same product for the protoxides (MO) of lead, mercury, manganese, nickel, copper, averages 72.03., the lowest being 70.01, and the highest 76.21. Similarly for the sulphurets of iron, nickel, cobalt, zinc, lead, mercury, and tin, the product varies from .71.34 to 78.34. But for the basic oxides (whose formula is M_2O_3) this number varies from 158.56 to 180., and similarly for the similarly constituted sulphurets M_2S_3. For the substance of the form M_2Cl_2 (chlorurets of sodium, potassium, mercury, copper, and silver) the number varies from 156.97 to 163.42. For the sulphates ($MO + SO_3$) of barytes, strontian, lead, magnesia, lime, the product varies from 164.01 to 168.49. For the carbonates ($MO + CO_2$) this number varies from 131.61 to 138.16. The more complex chemical substances give still higher numbers: the nitrates ($NO_5 + M_2O$) give 301.72. Arseniate of lead $As_2O_5 + 3\,P_6O$ gives 409.37. The law resulting from these experiments is thus announced by M. Regnault himself: "Dans tous les corps composés de même composition atomique et de constitution chemique semblable, les chaleurs spécifiques sont en raison inverse des poids atomiques."

Before proceeding to the consideration of these more complicated cases, it will be as well to state more fully the reasons for assuming, in my last paper, that

$$\frac{r'-r}{s'-s}=\frac{B}{A}$$

(The reader will have noticed a slight misprint of this equation in the last paper.)

The substance (n) and the mercury in the thermometer, being equally exposed to the action of the quantity of heat, C, the pressure resulting from this, and which produces the increment of molecular distance ($p'-p$) in the mercury, and ($r'-r$) in the substance (n) will necessarily be the same for both. Denote it by P. Then we have the dilatation ($p'-p$) produced by the pressure, P, acting in opposition to the resistance, R, and it is at least "highly probable" that this dilatation is directly proportional to the former force, and inversely proportional to the latter, so that ($p'-p$) is proportional to $\frac{P}{R}$. (We know that in elastic strings the increase of length is, *cæteris paribus*, proportional to the weight or pressure which stretches the string.) Similarly ($r'-r$) is proportional to $\frac{P}{A}$. Therefore $\frac{r'-r}{p'-p}$ is proportional to $\frac{R}{A}$. Similarly $\frac{s'-s}{p'-p}$ is proportional to $\frac{R}{B}$; whence, lastly,

$$\frac{r'-r}{s'-s} \text{ is proportional to } \frac{B}{A}.$$

If we take $\frac{r'-r}{p'-p}=\frac{R}{A}$, then the ratio of the specific heats of the two substances will be given by the equation

$$\frac{\text{Specific heat of substance } (m)}{\text{Specific heat of substance } (n)}=\frac{mB\,(s'-s)+N.R\,(p'-p)}{nA\,(r'-r)+N.R\,(p'-p}$$

$$=\frac{mB\,(s'-s)\left[1+\frac{N}{m}\right]}{nA\,(r'-r)\left[1+\frac{N}{n}\right]}=\frac{m\left(1+\frac{N}{m}\right)}{n\left(1+\frac{N}{n}\right)}.$$

N being the number of particles in mercury; and (m) and (n), those in the two substances whose masses are supposed to be very great compared with that of the mercury. The two fractions $\frac{N}{m}$ and $\frac{N}{n}$ are each very small quantities; in fact, they are the same as the following fractions.

$$\frac{\text{weight of mercury in thermometer}}{\text{weight of substance operated on}}\times\frac{\text{atomic weight of substance}}{\text{atomic weight of mercury}}.$$

Digitized by Google

and are not only small from the small quantity of mercury used, but also from the atomic weight of mercury being so much greater than of most other bodies.

If we now endeavour to apply the same reasoning to the case of compound particles where there is a tendency to, and may be an actual occurrence of, chemical decomposition, we shall see at once how variations from the law would arise, if the comparison be made between the specific heat of substances of *different* orders of molecular complexity. Take, for example, an oxide, whose particles each consist of the two simpler molecules, M and O. Between one of these *compound* particles and the next let the mean resistance to expansion be denoted by A_1, and dilatation by dr_1. And between the molecule, M, in any one of these compound particles and the other molecule, O, in the same particle, let the resistance be denoted by A_2, and dilatation by dr_2. Then, as before, we should have

$$C = N.R\,(p' - p) + nA_1\,.dr_1 + n.A_2\,dr_2.$$
$$\text{Similarly } C' = N.R.\,(p' - p) + mB_1\,ds_1 + mB_2\,ds_2.$$

What relations, however, can be assumed, with any degree of safety, between A_1, dr_1, A_2, dr_2, &c., it is not easy to see. A_1 and A_2 belong to *different orders* of forces—the one producing simply an expansion between two compound particles, and the other separations of the simpler or "ultimate" constituents of the compound particle. The latter force, in general parlance, would be termed a chemical force, as being of a different kind from the former, which would be called a "cohesive" force, or some such name. The difference, however, can only consist in different degrees of energy and different laws of variation, according to the distance. All the phenomena of nature are but the manifestations of different orders of forces, each order producing its own class of facts, and the different orders not interfering at all with each other's peculiar effects. Thus the force of "gravitation" affects the larger masses without interfering with the effect of heat in dilating the minuter particles, or with a still different order of forces whose action is on still smaller molecules. And as we, in our limited experience, are able to observe but a few of these different orders, it is probable that the series may extend far beyond anything of which our senses can inform us, and gravitation itself may be to other forces what "chemical" attractions are to it. Our solar or sidereal system may be moving in accordance with some different order of force to that of gravitation, just as our planet is moving in obedience to a different order from that which produces what we term chemical decomposition. And still further we may rationally conclude that all these different orders of force are bound up in one general law; or, to use the language of mathematics, which will convey perhaps more clearly the meaning intended, we may say that, as we express all the facts of gravitation by one formula, if our knowledge were sufficient to enable us to express all the facts of heat, chemical action, &c., by other such formula,—and if still further we had cognizance of facts beyond the greatest and least limits of our present observation, and knew the law of force governing the motion of those minuter molecules to which even chemistry does not reach, and on the verge of creation could attain similar knowledge as to the law of force by which our solar system is governed and moves like an atom with regard to a still higher system, and that again in its turn as portion of a yet higher—all these single and individual formulæ would no doubt be comprised in one primary formula, the knowledge of which would just as certainly and easily lead to the foreseeing and explaining of all the phenomena of the universe as the formula

$$f = \frac{\mu}{r}$$ leads to the prediction and explanation of all the motions of our planetary system.

The reader must excuse this digression—and as "from the sublime to the ridiculous there is but a step," he will probably be thinking that this "formula" must be that "equation finale" of the Frenchman mentioned by Robison, in his article on "Corpuscular Action," which equation expresses "touts les faits possibles." Considerations of this sort come almost inevitably to those whose attention is at all directed to such subjects; and, indeed, since writing the pre-

Digitized by Google

ceding remarks, the following passage in the same article of Robison's has caught my eye, which I do not recollect having read before: "The modifications of cohesion are innumerable, producing an endless variety of sensible forms, solid, fluid, vaporous, in each of which the law of action between the corpuscles is probably different. Also, in each of these forms we have subordinate varieties, which makes bodies hard, soft, elastic, unelastic, plastic, ductile, viscid; and, lastly, there are other modifications of the corpuscular force which produce the phenomena of solution, precipitation, crystallisation, &c., &c. All and each of these are ultimately mechanical forces, producing local motion and changes of motion. In this range of observation there are two extremes. On the one hand, enlarging our scale, we have electricity, magnetism, and gravitation. This last leads us to the bounds of the solar system; nay, there are appearances which render it probable that it extends at least to some of the fixed stars. But we have not sufficient authority for extending it to all.—Gravitation may cease at a certain distance; nay, it may change to a repulsive force at greater distances, and the visible universe may consist of parcels which are in equilibrio with one another, as the particles of a common body are in equilibrio between a state of attraction and repulsion. Each parcel of connected stars, magnificent as it is in our eye, may thus constitute a portion or particle of the universe: our imaginations are lost in the contemplation of such a scene. But there is no absurdity in the thought. The ingenious Dr. Halley proved, from the law of gravitation, that there may be *within* this globe a scene of existence and habitation altogether undisturbed by the gravitation of external bodies, yet everything having weight and stability nearly the same as on the surface of the earth. To its inhabitants the scene may appear as extensive as the heavens appear to us." (*Mech. Philos.*, vol. i., p. 260, &c.)

It is needless to make any observations on the value to the chemist of such laws as those connecting the atomic weights with the specific heats. One remark only I will add. Both from theoretical considerations on the manner in which the greater or less complexity of the chemical composition of a body will affect its specific heat, and from the experimental results of M. Regnault, it is clear, that if we obtain by experimenting on two substances specific heats, such as to verify the law of inverse proportionality to the atomic weight, we may safely conclude a similarity of chemical composition, such, for instance, as might serve to decide whether a substance entered into a combination as a protoxide, or deutoxide, as a nitrate, or basic nitrate, &c. In organic chemistry, especially, the value of such a guide would be very great in all questions relating to "compound radicals," or "proximate elements"—the whole subject being a question as to the *different orders* of chemical forces—on which, as we have seen, the specific heat depends. So that, if one "compound radical" takes the place, or is capable of being substituted for another substance in any combination, the two may be said to be of the same order of force, and be expected to affect the specific heat of any combination in which they enter in the same way.

It has often occurred to me that many of the peculiar relations between oil and water, and other such dissimilar substances, are owing to the difference of magnitude between their ultimate particles. The particle of water, for instance, is HO, whose atomic weight is 9. A particle of oil of turpentine is represented (according to Gregory, "Organic Chemistry,") by $C_{10}H_8$, or $C_{20}H_{16}$, and therefore its atomic weight must be 68° or 136°. The disproportion is enormous, and if chemical analysis can be relied upon, in some other of the oils it is very much greater than even this.

How far this consideration is available in explaining Franklin's experiment I shall leave the reader to try, not having been able to obtain any distinct mechanical view of it myself: all that I can understand being merely this, that the motion communicated by the agitated water to the lower strata of the superjacent oil is, somehow or other, rapidly enfeebled and prevented from reaching the upper strata. In the case of only one medium, as for instance, the waves of the sea, there appears to be a similar effect, the agitation of the surface being only propagated to comparatively small depths. This fact I

Digitized by Google

believe has been found by experiment: namely, that at a certain number of feet below the surface of the ocean there is no perceptible disturbance caused by even the greatest waves on the surface. Lagrange takes notice of this fact in his investigation of the velocity of propagation of waves, and attributes it to the adherence or viscidity of the particles of water:

"Au reste, quelle que puisse être la profondeur de l'eau, et la figure de son fond, on pourra toujours employer la théorie précédente," (in which the whole depends on supposing the depressions and elevations very small compared to the other quantities which enter the problem); "si on suppose que dans la formation des ondes l'eau n'est ébranlée et remuée qu'à une profondeur très-petite, supposition qui est très plausible en elle-même, à cause de la tenacité et de l'adherence mutuelle des particles de l'eau, et que je trouve d'ailleurs confirmée par l'experience, même à l'égard des grandes ondes de la mer." (Mecanique Analytique, tom. ii., p. 335).

With regard to Franklin's experiment, I may add, that the fact evidenced in it has been long known to whalers, namely, the calmness of surface produced when large quantities of the whale oil are spread over the surface of the sea.

The consideration of the relative masses of the constituent particles of substances, (oil and water, for instance,) as influencing their mutual solvent and chemical action, leads to some interesting speculations. It is a general law, for example, that similarly constituted substances are the best solvents of each other:

"Avez-vous des métaux à dissoudre; pour cela prenez d'autres métaux; le mercure par exemple conviendra le plus souvent. Sont-ce des corps très oxidés, recourez en general aux dissolvans très oxidés; des corps très hydrogénés ce sont ordinairement des dissolvans très hydrogénés que vous devrez choisir. Une huile dissout facilement une graisse, une resine; eh bien! consulter la composition de ces corps, elle est toute semblable." (Dumas' Leçons de Philosophie Chimique, p. 391.)

Those who are disposed to indulge in such speculations will find materials in the work just cited—and as the author is one of the greatest chemists living, *his* speculations are not likely to be without solid support from experimental observation. There is also a curious note, referring in some degree to this question of the influence of the relative proportions of particles, in Boutigny's work, from which so many extracts have already been made. (P. 183, 4).

In the next paper, I intend to go into the question relating to Vaporisation and Evaporation, a subject involving, as one part, the question as to the relation between the pressure, temperature, and density of steam.

Note.

In Problem I, I have denoted the whole increment of pressure in a gas prevented from dilating, by $P\delta$, and added this to the work done in expanding the mercury. I question whether there is any more reason for doing this than there would be, in estimating the work done by a steam-engine, for adding in the pressure sustained by the crank-axle, or any other fixed part of the machinery, by means of which the force is transmitted. Therefore it appears to me that the following is the more correct way of treating this question. Let, as before, the quantity of heat, C, raise the mercury in contact with the expanding gas through one degree, or increase the distance of its particles by $(r'-r)$. And let C′ be the quantity of heat required to raise the mercury through the same space when the gas is confined to a constant volume. Then

$$C = P\delta + \varpi R(r'-r) \ldots\ldots \text{Pressure constant.}$$
$$C' = \varpi R(r'-r) \ldots\ldots \text{Volume constant.}$$
$$\therefore \frac{\text{Specific heat (pressure constant)}}{\text{Specific heat (volume constant)}} = \frac{C}{C'} = 1 + \frac{P\delta}{\varpi R(r'-r)},$$

the value given by experiment for common air is $1 + \frac{417}{1000}$ by some experimenters, and rather differently by others. If we take it to be about $\frac{2}{5}$, then $\frac{P\delta}{\varpi R(r'-r)} = \frac{2}{5}$.

Now in any experiment (δ) is known and also P, (which will vary with the volume of gas operated on, as well as on other circumstances,) there seems to be here, therefore, a method of obtaining a relation between the mean resistance of mercury to expansion through one degree (which however is itself variable towards the extremes of the scale) and the increment of molecular distance $(r'-r)$.

From the first of the preceding equations,

Digitized by Google

also, it is obvious that, other things being the same, the specific heat of a gas is less the smaller P is, *i. e.* the less the pressure it is subjected to. This is one of the results announced by M. M. Delarive and Marcet, from their experiments. Their other experimental law has been noticed already in the last paper. A. H.

CHAPTERS ON ANALYTICAL GEOMETRY.

BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from page 434.)

CHAP. VIII.—*On the Hyperboloid of Two Sheets.*

SECTION 1.—*Propositions.* By the aid of the following theorems we shall be able to recognise the equation to the hyperboloid of two sheets. Part of their enunciation is analogous to that of the propositions which I gave for distinguishing the equation to the ellipsoid,* but with an improvement of form.

I. *When a surface of the second degree can be met* in a point *by* [only†] *two planes parallel to, and at a finite distance from, one another; then—provided that planes drawn parallel and* exterior *to the former ones meet the surface—the surface is the* hyperboloid of two sheets.

II. *When a surface of the second degree is met* in a point or a straight line, NEITHER *by any of the coordinate planes* NOR *by any planes* whatever *drawn parallel to* any *of the coordinate planes, the surface is the* hyperboloid of two sheets.

III. *The hyperboloid of two sheets possesses the following property:*

It can EITHER *be met* in a point *by* [only†] *two planes parallel to a coordinate plane and at a finite distance from one another; in which case planes drawn parallel and* exterior *to those planes meet the* hyperboloid:

OR, *none of the coordinate planes, nor any plane* whatever *drawn parallel to any of the coordinate planes, can meet the hyperboloid either in a point or a straight line.*

SECTION 2.—*Examples.*

(*Ex.* 3.) What surface is represented by the equation

$$2x^2+5yz+3z^2+2yz-4zx-2xy=11\ ?$$

[Hymers, p. 149.]

Proceed as follows:

x^2	yx	zx	y^2	xy	z^2	1
2	−2	−4	5.	2	3	−11
.	.	.	×2	.	.	.
2^2	−2.2.	−4.2	10	4	6	−22
			1	4	4	
			3^2		2	−22
					.	.
					2^2	−44

The above process shows that the given equation may be reduced to the form

$$u^2+v^2+w^2-n^2=0.$$

Hence the surface to which it belongs has *not* the property described in Proposition III., and is not, consequently, the *hyperboloid of two sheets.** Dr. Hymers appears to have fallen into error in treating this example.

(*Ex.* 4.) What surface is represented by†

$$yz+zx+xy-x-2y-3z+2-a=0\ ?$$

This equation is equivalent to

$$(x+r)\times(y+s)+\phi(z)=0\ldots\ [A]$$

where, $r=z-2$,

$$s=z-1, \text{ and } \phi(z)=-z^2-a;$$

and [A] can only represent a point or a straight line when

$$\phi(z)=-z^2-a=0,$$

or, $z=\pm\sqrt{-a}$

an unreal value of z: in other words, the surface cannot be met in a point or a straight line by any plane parallel to that of xy, nor is it so met by the plane xy. The same thing is true of the other coordinate planes as a similar process will readily show us. Hence, by Proposition II., the surface is the hyperboloid of two sheets (double or point-hyperboloid.)

SECTION 3. *General Remarks.* If a coordinate plane be parallel to a tangent to the ASYMPTOTIC CONE of the hyperboloid of two sheets, the "two planes" mention-

---

* *Supra*, pages 360, 361.

† This word "only" serves to distinguish the hyperboloid of two sheets from the single straight line to which the proposition would otherwise apply. The straight line is not however in strictness a *surface*, although it may not always be able at first sight to distinguish its equation from that of a surface, the term "plane parallel to a coordinate plane." In the coordinate plane itself is meant to be included.

* The surface is in fact an ellipsoid; (*Vide supra*, page 360, and compare with the investigation in the text). Dr. Hymers has assigned the equation in s erroneously. That equation should be

$$s^3-10s^2+25s-9=0,$$

in which there are three changes of sign—the indication of an ellipsoid.

† *See* Leroy, p. 160, No. 242. The case of the hyperboloid of one sheet is alluded to in the concluding paragraph of that article.

Digitized by Google

ed in Prop. I. coincide and the point in which the hyperboloid is met by the resulting single plane lies at an infinite distance. This is a critical case. In the critical case of the elliptic paraboloid there are *two* infinitely distant points of contact. Let a plane be drawn through the centre of the surface parallel to a coordinate plane; then, (1), if the plane so drawn meet the ASYMPTOTIC CONE in a point, the hyperboloid can be met in a point by two planes parallel to this plane; (2) if the plane meet the cone in a single straight line, we have the critical case just mentioned; (3) if the plane meet the cone in two straight lines, the hyperboloid cannot be met in a point by any plane parallel to the plane in question.

Great Oakley, near Harwich, Essex,
October 30, 1847.

Postscript. The following corrections are required in my last *Chapter*;

Supra, page 428, line 28, *for* — *read* +; page 434, line 3, *for* $(2y-3z^2)$ *read* $(3y-3z)$ [B]

NECESSITY OF INQUIRY INTO THE STATE OF THE DIFFERENT BRANCHES OF OUR NATIONAL INDUSTRY.

Sir,—There is probably no country in the world where inventors labour under greater disadvantages than they do in England. There is by no means a deficiency of mechanical genius in the country, but it is unquestionably a misfortune to probably ninety-nine out of every hundred, that ever the goddess of genius smiled benignantly upon them.

Inventors, no doubt, have their lucid intervals, and enjoy a pleasure peculiar to themselves, and which cannot be comprehended by those whose minds have never been sublimed in the crucible of mechanical and experimental science.

If inventors were not too frequently a pennyless set of unfortunates, of which the writer (at all events in this respect) is an eminent type, they would enjoy a full average of the bliss of mortals.

An inventor in tolerably easy circumstances, who can handle his tools, and command some portion of his time, may be classed among the most fortunate of the race; and notwithstanding the many rebuffs he may meet with from those to whom he might naturally look for some encouragement, still it is not intended to pen a jeremiad on behalf of unfortunate inventors, but simply to make a few suggestions, which, if adopted, would benefit those who are in possession of substantial projects, but unable for want of funds to bring them forward—who are, therefore, doomed to endure the pangs of disappointed ambition, for it is presumable that their pursuits are as worthy of the name of ambition as the pursuits of the warrior who carries devastation in his train. The country is also deprived of the advantage of many highly important improvements which it might, and which it ought to possess.

I am not, however, going to be guilty of the extreme folly of supposing that the Government either will, or ought to do anything in the matter, or indeed, any board or department under the immediate control of Government. It would be cruel to afflict inventors with a nightmare of this description.

I would therefore suggest that a committee be formed, consisting of the most scientific and practical engineers, directors, and others connected with each department of mechanical, manufacturing, or scientific undertaking, and that these committees should investigate all such matters connected with their several departments, as might be submitted to them by inventors or others.

The constitution of these committees would be such, that inventors in many cases would be disposed to submit their projects to them before incurring the various preliminary expenses which they now frequently incur, and can in many cases but ill afford.

But, to particularize—take first the railway interest; the general committee in this case would consist of civil and mechanical engineers, and railway managers; and projects brought under the notice of this committee would be referred to a sub-committee of those best qualified to form a correct opinion upon the particular subject referred to them. Suppose such a committee had been in existence previously to the construction of many of the existing railway bridges, and that this committee had had funds placed at its disposal to institute a well-directed set of experiments, (the expense to be borne by the whole railway interest,) no such structure as the Dee bridge, or any of that *negative-truss-bar* class would have been in existence.

At present, a committee of this de-

Digitized by Google

scription could very advantageously investigate the subject of railway signals, the application of breaks, position of points leading into sidings, and all such matters as relate to the safety of railway travelling.

By this means one most important object would be attained, that is, uniformity of practice in the various manipulations of railway management, so that the engine-drivers and other parties changing from one railway company to another, would not be led into mistakes (resulting in fearful accidents,) caused by different arrangements upon railways under different management.

Matters of prudential economy might not be altogether out of the question in the present aspect of railway affairs, and the investigation of cheaper modes of conveying passengers and goods than those at present in operation.

Then, secondly, take the mining interest in connection with the various plans proposed for raising water. How soon would a committee of competent persons connected with that important undertaking, empowered to make substantial experiments, decide the fate of the spray-pump, either one way or the other? The published statements at present respecting this invention are so contradictory as to baffle every attempt at forming even an approximate opinion of its merits.

The various coal-works subject to inflammable or noxious gases, would, no doubt, be much benefited by frequent consultations of the best-informed parties connected with these undertakings. When accidents take place, the proposed committees in this, as in other cases, might assist with their collective knowledge of the subject in endeavouring to discover the cause of an accident, with the view to the adoption of the most efficient means to prevent the recurrence of future calamities. By this means responsibility would rest where it ought to rest, the parties concerned would be considered completely out of leading-strings, and the great national industrial establishments would prosper under absolute self-control, leaving the Government to attend to its own legitimate sphere.

Numerous examples might be adduced of the advantages which would result from a concentration of scientific and practical knowledge thus brought to bear upon the various departments of productive labour.

A desire not to trench too far upon your valuable columns, induces the writer however to draw to a close.

I am, Sir, yours, &c.,

A.

THE MIXED GAUGE.

A railway, on the double-gauge plan of Mr. Brunel, has been opened between Gloucester and Cheltenham, with a success unalloyed as yet by disaster, death, or damage; and certain journals which delight in doing honour to the whims of this eccentric engineer, are boasting of the result as the best possible refutation which he could have furnished of the published objections of Mr. Robert Stephenson to a mixture of the broad and narrow gauges. Now it can hardly be unknown to these braggarts—but whether known to them or no, it is due to truth that all the world should know—that the Gloucester and Cheltenham has always been regarded as an exceptional case in regard to the question at issue, and was expressly pointed out as being so by Mr. Stephenson himself. "*I do not think the Cheltenham and Gloucester will be a fair trial*"—Mr. Stephenson's own words. The reasons for its not being so, are well set forth in a letter from Mr. S. Sidney, to the *Railway Record*, from which we make the following extract:

"On the double-gauge line between Gloucester and Cheltenham there are no difficulties or dangers, because the stations of the Broad-gauge Company and of the Narrow-gauge Company at either terminus are *entirely separate*, and there are *no intermediate stations*, or *through crossings* joining the up line and down line. Mr. Stephenson has stated, in evidence, 'that the addition of a third rail into a common railway, where there are *no* stations or intermixture from *side to side*, is, vulgarly speaking, as plain as a pikestaff.' * * Mr. Brunel, on Parliamentary Committees, last session, having proposed to introduce the double-gauge system on upwards of 400 miles of railway, Mr. Stephenson was required to consider, not only cases "as plain as a pikestaff," like the Cheltenham and Gloucester, but also cases in which, in addition to the present inevitable complications of stations and crossings, the additional complication of a third rail would require to be added."

Digitized by Google

Another correspondent of the same journal forcibly observes:

"Mr. Robert Stephenson, in his Report, gives a detailed statement of thirty-nine accidents on the Midland Railway in one year only, all of which are attributable to crossing-points and switches. This is only with the one gauge; what, then, are we to expect, or rather what may we not fear, from the mixed gauge? Mr. Stephenson's Report is founded on practical experience, and not on supposition. Have not that gentleman's assertions been verified in the atmospheric affair, while the reports of Mr. Brunel have fallen—condemned, with the system?

"It appears that Mr. Brunel has now gratified his ambition; his success is considered complete. The expense of this achievment is altogether left out of the question. In addition to the waste of capital, land, &c., for the broad gauge, an extra cost of 5,974*l.* per mile has been expended to form the mixed gauge. This is Mr. Brunel's engineering success!"

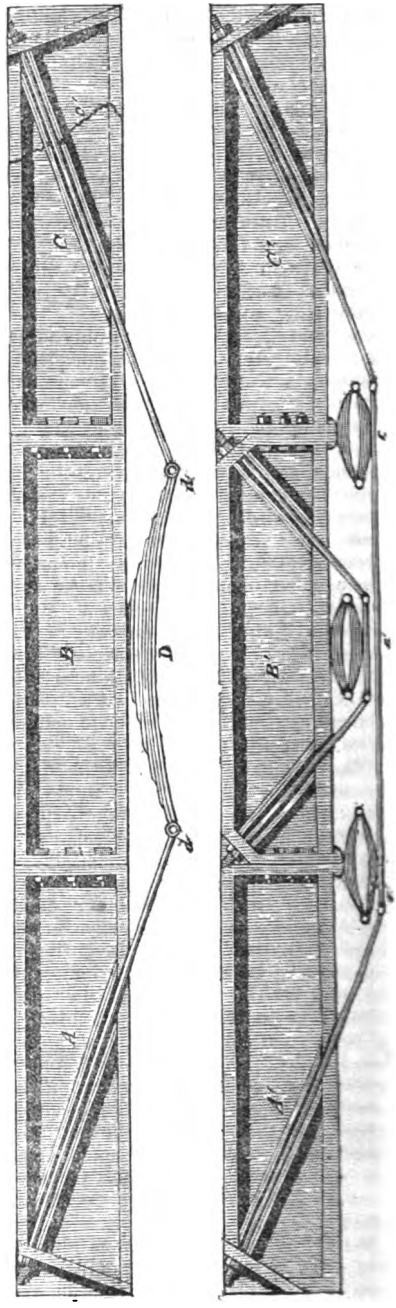
GIBBON'S PATENT IMPROVEMENTS IN TRUSSING BEAMS AND GIRDERS.

The requirements of railway and other bridge buildings, coupled with the excitement occasioned by the late accident at Chester, have strongly directed the attention of scientific men to the best means of obtaining increased safety for such structures.

Cast-iron girders of very large dimensions are now in constant use, and for security are trussed with wrought-iron rods, but from the changes which are continually going on in the crystalline structure of the metals, from unequal expansion and contraction by variations of temperature, as well as from causes of which as yet we know but little, great uncertainty prevails as to the permanent strength of such combinations. W. Gibbon, Esq., of Corbyns'-hall Iron-works, has recently devised and patented a plan for increasing the safety of cast-iron beams and girders in their various applications, which displays much ingenuity, although somewhat opposed to preconceived notions.

Mr. Gibbon proposes to abandon the rigid trusses heretofore employed, and to substitute others of an elastic nature, as will be understood by the accompanying diagrams, (somewhat distorted in dimensions and arrangement, to show them

Fig. 1. Fig. 2.



Digitized by Google

clearly within the limits of a column.) Fig. 1, is intended to represent three cast-iron girders, A, B, C, of considerable length, bolted together in the usual way; from abutment flanges at the extremities, rods pass down on each side and are secured to the ends of a powerful spring, D, which abuts against the under side of the central girder, B. When the girder is of considerable width, several of these springs may be employed, ranged side by side, the bearing-rods, *d d*, being common to the series. Fig. 2, shows another form of spring, and also differently arranged. A′ B′ C′, as before, are three girders; tension-rods pass down on each side from the two extremities, to a horizontal bar which impinges on the springs, *e*, *e*, placed beneath the end flanges of the three girders. The central girder, B′, is trussed with a spring, *e′*, in a similar manner. Ribs are cast upon the girders, and form grooves for the tension-rods to lay in, the interval between them being just sufficient to admit the tension-rods, without their being bound. In the event of a girder being fractured, these ribs take a bearing on the tension-rods, which prevents the broken parts from falling asunder. This will be seen in reference to the girder, C, fig. 1, which is shown as fractured at *c′*, but is preserved in tact by the tension-rods. It is probable, indeed, that if each of the girders was broken, the ribs, tension-rods, and springs would hold it together, if originally made as strong as under any circumstances they ought to be. Springs for locomotive engines are constructed to bear upwards of six tons in motion, and can be made much stronger, especially when used at rest. If we suppose the case of a girder, similar to fig. 1, and so wide as to permit six springs to be placed side by side at D, each spring capable of bearing eight tons and brought to bear with that force on the underside of the girder, B, the effect of this would be to ease the centre of the bridge to the extent of nearly fifty tons, and that not varying much under any changes of temperature. Had the Dee-bridge been thus protected it is most likely it would not have fallen.

The springs should, of course, be tested previous to being fixed, and should be allowed but little play; perhaps half an inch would in nearly all cases be sufficient.

B.

MR. SAMUEL'S RAILWAY EXPRESS ENGINE.—LIGHT ENGINES FOR LIGHT WEIGHTS.

To those who can read the signs of the future in the indications of the present, last Saturday was an epoch in railway affairs; for, on that day, "thought became a fact," pregnant with consequences. On that day, the resident engineer of the Eastern Counties' Railway, by the aid of *twenty-two hundred weight* of metal, timber, fuel, and water, conveyed seven persons from London to Cambridge, at the rate of 40 miles per hour—a feat which, up to that period, could only be accomplished by putting in motion *thirty tons* of inert matter. To those who ask the *cui bono?* we reply, that it is an indication of a reduction in the working expenses of railways, by the diminution of dead weight—an indication of increased durability of rails and roadway, and reduction in the cost of maintenance of way—an indication of greater speed than has yet been attained, and at a lessened cost—an indication of yet cheaper transit to the community, with increased profit to the shareholders—an indication of the extended use of railways, in many modes not hitherto dreamt of—an indication that steam carriages on railways may be advantageously applied to many purposes for which steam tugs (the existing locomotives) are not well adapted—and more than an indication, a direct offer, by authority, to the periodical press, to forward their reporters and messengers to the various scenes of their labours, on future occasions, at a cost of one-fourth the price hitherto charged. This is no merely curious experiment, but practical everyday business. Several pounds per day is the cost of an ordinary locomotive—fewer shillings is the cost of this new candidate for passenger transit. And be it remembered that this first "steam carriage" on railways, satisfactory though it be, still lacks the improvement of experience. The amount of improvement in the second of its class we cannot yet pronounce upon; but it is calculated that two tons of matter will convey twenty passengers, in a closed carriage, at the rate of sixty miles per hour; 40cwt. of dead load to 30cwt. of available load, or duty. And, after that experience be gained, it is probable that the third carriage will, with a dead load of 60cwt., convey sixty passengers, or 90cwt., for the dead load will diminish in proportion to the number of passengers.

A stage-coach of former times weighed about 1 ton; the four horses and harness, about 1½ tons—50 cwt.; guard and coachman, 3 cwt.; total, 53 cwt. By this apparatus, 17 passengers were carried at a rate

Digitized by Google

of 10 miles per hour; about 24 cwt.,—so that 2 cwt. dead load carried 1 cwt. available load.

An engine, tender, three first, and six second-class carriages, with driver, stoker, and guards, weigh about 70 tons on the Eastern lines. They will carry 192 passengers, at the rate of 30 miles per hour—about 268 cwt. of available load to 1,400 cwts. of dead load, or about 5 cwt. dead load to 1 cwt. available load.

A Great-Western express train weighs about 70 tons. The passengers, 128 in number, weigh about 9½ tons, which will be nearly 11 cwt. dead load to 1 cwt. available load.

The Eastern Counties' steam-carriage weighs 22 cwt., and carries 7 passengers, weight 10½ cwts.; about 2 cwt. of dead load to 1 cwt. available load. This is about equivalent to the old stage-coach, in proportion of materials, at quadrupled speed.

But, if at a future time, 3 tons of dead load will carry 4½ tons of available load, that will be the proportion of 1 cwt. of dead load to 1½ cwt. of available load.

It is not possible that principles of so great importance should be suffered to lie in abeyance; and we think that the Directors of the Eastern Counties' Railway have shown great clear-sightedness in sanctioning their engineer, Mr. Samuel, in so important an experiment. We foresee numerous purposes to which these steam-carriages may be applied, and shall be much surprised if the Post-office do not grapple at once with so cheap a means of rapid transit: and we shall also be surprised if it does not induce Directors to institute inquiries and experiments as to what amount of power is actually generated in their engines, for the purpose of overcoming their own friction. The result of this novel vehicle is most creditable to all the parties concerned. We believe that Mr. Samuel was the original propounder of it, for the Eastern Counties' Railway; and, when sanctioned by the Directors, the working drawings were made, under his superintendence, by his then assistant, Mr. Reynolds. It was constructed by Messrs. Adams, of the Fairfield Works, and we shall be glad to witness the launching of the second of its class from the same establishment.—*Railway Record, Oct. 30th.*

BOILER EXPLOSION AT ROCHDALE.

There has been a boiler explosion at New Hey Mill, Rochdale, by which four persons have been killed and several others severely injured. The evidence given at the inquest on the bodies of the deceased, discloses a state of things, which one would have supposed beforehand, could not possibly exist anywhere in the three kingdoms. The boiler was some twenty years old—so old that nobody could remember by whom it was made; it was originally wagon-shaped, but had some time or other been changed into the cylindrical form; the rivet-holes were much closer than usual, and the rivets were larger than should be put to a boiler with plates of ordinary thickness, and badly placed; thus "*taking away*," as the *Manchester Guardian*, justly observes, "*more strength from the plate than they gave to it.*" Again: the steam-gauge was without mercury—it was plugged with an iron plug, and the cock had not been turned for some years!!! Then, the safety-valve was of an area preposterously small compared with that of the boiler, and its spindle positively throttled by a hempen collar or stuffing-box. Mr. James Nasmyth, the eminent engineer, who was one of the witnesses examined, observed on this head:

"I have seldom seen a valve in so cruel a condition. A practice which I should much reprobate, is the application of stuffing to the valve. It is a very common practice, but it is a highly reprehensible one. I believe that the practice of covering and stuffing the valve, from the simple desire of preventing the steam coming into the engine-house, is exceedingly defective and improper. It would be doing a great public good to prevent the continuance of such things. When there is hemp round the spindle in this manner, and it is exposed to the action of water, an oxydation and fretting take place, and it is sure very soon to become rusty."

The Engineer, or "Engine-tenter," as he is called in Yorkshire, was every way worthy of the precious sort of engine he had to take charge of. He was a lad of eighteen, who had never had the sole charge of a steam-engine before, though he had assisted for three years working an engine at another place; and of his qualifications for the office he gave the following amusing proofs in answer to questions put to him:

"I never took the safety-valve out of the box to look at it; I used to oil the rods and things about it. I never had the stuffing-box out; sometimes there would be a little steam escape from the box, and sometimes a little water. I do not know that the valve ever stuck since I went to the mill: I had no means of knowing if the steam was too high; except by the valve—By the Foreman: I do not know how many pounds to the inch I used to work at: I thought I had nine pounds. I thought there were four square inches in the valve, and I multiplied the weight there was there by that four inches; that would be about 89 lbs.: then I divided this by nine, because I thought there would be as many

Digitized by Google

pounds as there were nine inches.—The Foreman: What made you think about nine inches; where did you get them?—The witness hesitated, and afterwards said, in answer to the Coroner,—*I know nothing at all about it, nor why I made these calculations. I never learned any thing at all about it, but only from hearing other folk talk about it.*"

On hearing the evidence of this fine specimen of the Rule of Thumb Boys, Mr. Nasmyth made the following very apposite observations:

"From the engine being generally neglected, and the whole being put into the hands of a person so low in intellect as this lad evidently was, he did not at all wonder at the boiler blowing up. To trust machinery, on which the lives of so many persons depended, in the hands of such a person, was very reprehensible; he might have gone to the valve, given it a shake, and thought he heard the steam; but it was very evident that, generally, he knew nothing about the matter. The boiler was defective, old, and patched, and was quite inadequate to resist the pressure required; but of whatever strength it might have been it must have given way at some time, with such a valve, and under such management. It was very important that parties employing engine-men should pass them through some sort of catechising, to see that they were possessed of some small amount of intelligence, and some fitness for the important station they filled. There was more risk to the public from these little petty concerns, where defective machinery was employed, than from the largest establishments, in which there was a proper supervision."

The jury returned the following sensible verdict:

"We find that the safety-valve was defective in construction, and neglected in condition: that it appears the mercurial steam gauge was plugged with an iron plug, and consequently useless; and we beg to express a strong opinion, that the engine-tenter is incompetent for his situation, and that great blame is attachable to parties employing such incompetent persons in such responsible situations."

THE ATMOSPHERIC RAILWAY SYSTEM.

We extract the following paragraph from the *West of England Conservative:*

"The atmospheric railway system of traction is now in constant operation, on the 15½ miles of railway, between Exeter and Teignmouth. There are every day (Sundays excepted) propelled by this process, four passenger trains up, and three passenger trains down, a heavy goods train, and the whole is accomplished with the greatest regularity. The speed, which is admirably under control, averages upwards of 30 miles an hour; the stoppages at the St. Thomas, Starcross, and Dawlish stations, are so managed, that the trains are brought to a stand still with the greatest ease and precision—in fact, as easily as those propelled by the locomotive engine: the starting from the respective stations is also conducted in a very ingenious, though simple, manner—atmospherically, by the assistance of an auxiliary tube. The train, on the usual signal—the guard's whistle—being given, gently runs on to the mouth of the continuous tube, a short distance from the platform, and immediately as the piston enters, the full force of the atmospheric pressure is felt—the speed is increased, and the train rattles along with wonderful rapidity, which can at all times be checked and regulated by the engineer, by the application of an exceedingly powerful break, which he can apply instantly and simultaneously to the six wheels of the carriage. In the course of a fortnight, the first atmospheric train will run to Newton—a distance of 20½ miles from Exeter; and in a short time, we learn, the locomotive engines will be entirely removed from that portion of the railway. The tubing is also being laid towards Totness, the pipes being 22 inches in diameter, as the gradients between that town and Newton are very stiff; about a mile is nearly perfected, and a double line is constructing. The engine-houses are also rapidly progressing.

Have we still our doubts? Yes; because it is to be inferred from what is said about the *locomotive engines* being "in a short time" entirely removed, that assistance from them was requisite to produce the preceding results—because we are not told what the amount of that assistance has been—because we cannot imagine how a system which failed so utterly when tried between London and Croydon, under the most favourable circumstances should succeed so well between Exeter and Teignmouth—and because, finally, the real question remaining to be solved is, not whether railways can be worked on the atmospheric system—which has been long ago settled in the affirmative—but, whether they can be worked as cheaply and as conveniently as by locomotive carriages? On this point of expense our "Conservative" friend is silent.

MR. HUNT'S NEW DIVISION OF THE SUN'S RAYS.—LIGHT, HEAT, ACTINISM.

About six years ago, Mr. R. Hunt, of the Museum of Economic Geology, announced that he had discovered that, associated with the light and heat derived from the sun, there is another principle most active in producing changes in the organic and inorganic worlds. This principle he at first called *Energia*; but afterwards, on the suggestion of Sir John Herschel, it was called *Actinism* (from the Greek ακτιν, a ray of the sun.)

At a recent meeting of the Royal Cornwall Polytechnic Society, Mr. Hunt stated that all his scientific researches had fully confirmed the existence of the three principles; and he gave the following striking evidences of the truth of his discovery, derived from the vegetable world. That the actinic principle was necessary to germination, was shown by the fact, that seeds placed under the influence of solar rays transmitted through yellow glass, would not germinate, because yellow glass prevents the passage of the actinic principle. Accordingly, during spring, the solar beam contained a larger amount of the actinic

Digitized by Google

principle than at any other, because it was necessary at that season for the germination of seeds and the development of buds. In summer, again, there was a larger proportion of the light-giving principle, necessary to the formation of the woody portions of plants. And towards autumn, the calorific, heat-giving, or ripening principle of the solar rays increased. It resulted from these principles that the recent use in greenhouses of white German sheet glass was most objectionable. Under this kind of glass, plants were subject to an injurious solar influence which they had not suffered under the old crown glass. It became therefore, necessary, to discover some means to cut off those *parathermic* rays, which, passing through the white glass, scorched and browned particular portions of the leaves, without cutting off the other portions of the rays, which were necessary to the growth of the plant. With this view, Mr. Hunt has devised and applied at the Kew Observatory a green glass, stained with oxide of copper, which effectually excludes the injurious parathermic rays, while it admits the other solar rays necessary for the plant, as freely as ordinary white glass. In the manufacture of this green glass, it was essential that no manganese should be used, as was the case in white glass. If manganese were used, the glass would, after a while, assume a pinkish hue, which would more freely admit the burning rays.

AMERICAN TAPESTRY CARPETING.

This beautiful branch of manufacture, hitherto exclusively foreign, has recently been introduced into this country, and bids fair to become a profitable and extensive business. With that energy and enterprising spirit so characteristic of the mechanics and manufacturers of our country, Messrs. Clark and Hartman, of Clappville, Mass., have embarked in this business, and we are gratified to learn that it promises to be abundantly successful. We have seen specimens of their manufacture which are equal in appearance to the finest Brussels, and one of its peculiarities consists in having the figure beautifully and ingeniously printed upon *the warp* before being woven, instead of the insertion of the various separate colours during the process of weaving, as is generally practised in Europe.

The back of the web is of flax, or hemp, rendering it very strong and durable. It is woven on a simple common loom, requiring no extra harness or pattern-guides, as the figure, whatever its form or character, whether groups of flowers, landscape, or fancy sketches, must come in right in the weaving. The colours are laid upon the warp of the printing-machine with such mathematical precision that there is no possibility of getting the figures wrong. The entire machinery for this business is of American origin, and patented. It was invented by Mr. Hartman, who is by birth a Scotchman, but a naturalized citizen of the United States, having been in this country over twenty years, and was only acquainted with the Scotch plaid and ingrain carpet when he left his native home. He has been now more than three years perfecting his machinery and making experiments with his colouring-matter and process. He has now three printing-machines in operation that print *one hundred yards each per day.** He has also about a dozen looms ready for weaving. The company have put up a building this spring for one hundred looms. The first piece of carpeting of the kind manufactured in America was made by this firm last April, and since that time until quite recently, they have done little more than make experiments in order to procure a perfect article. Mr. Hartman says, that in bringing out this machinery, he is not indebted to Europe for any part of it; and so confident was he of success, that he expended his whole property on it long before it was completed, and was only able to mature it by parting with one-fourth of his interest in the patent; and if he had failed, his family and himself must have been left pennyless. It gives us peculiar pleasure, however, to say that success seems to crown his efforts, while *he* rejoices that his invention is *altogether American.—Farmer and Mech.*——["*Altogether American,*" and yet the inventor a Scotchman!]

THE SCREW GUARD-SHIP "BLENHEIM."

The *Blenheim* steam guard ship was an old 74, built at Deptford, in 1813, and of 1,747 tons. She has had her poop and upper works cut down after the fashion of a flush-decked frigate, a gigantic specimen of which class of vessel she now appears, mounting on her upper deck two 56-pounders, 10 feet long, 88 cwt. each; two 10-inch beam guns on the quarter deck, 10 feet long; two 56-pounders pointing forward, and two beam guns, 10-inch; total on upper deck, eight, all on traversing pivots. On the main deck she carries 22 32-pounders, eight

* The plan of block printing on the warp was introduced into Scotland about eight years ago, and to this time, by their method, one man can only get off from ten to fifteen yards per day; but Mr. H. did not, nor does he yet know, their method of calculation for laying the figure, or preparing the colours. Mr. H. sets the colours by steaming after printing, and uses every variety of shade.

Digitized by Google

feet long, and from 42 cwt. to 45 cwt. each. On the lower deck, 26 42-pounders, 9ft. 6in. long, and 67 cwt. each. Grand total armament, 56 heavy long guns. Her engines are of 450-horse power, by Messrs. Seaward and Capell, and of the direct action kind, (horizontal,) averaging 45 revolutions per minute. Her screw is of 20 feet pitch with two blades, and is worked by the engines directly. Her funnel is of the telescope kind, and lowered by a winch. The vessel was tried recently with all her sea-going weights in, and ballast in lieu of her sea-going quantity of provisions and ammunition. On this occasion she was under the temporary command of Captain Horatio Austen, R.N., the able Government steam-ship Inspector, assisted by Lieutenant Robertson. The following is an authentic detail of the whole of her workings and performances:

Total distance run, 222 miles.

Number of hours under steam, 50¾.

The total expenditure of fuel 84½, being at the rate of 36 tons for 24 hours.

The *maximum* speed obtained with engines alone in a royal breeze, free, the engines making 42 strokes, and the barometer 25½, 6 6-10 knots.

The *maximum* speed obtained with engines alone in a moderate royal breeze ahead, 5 5-10 knots.

The *maximum* speed obtained with engines and sail in a single reef topsail, and topgallant breeze abeam, the engines making 46 revolutions, and the barometer 24½, 8 5-10 knots.

The *maximum* speed with sail alone, under the same circumstances, 4 5-10 knots.

The *maximum* speed obtained with engines and fore and aft sails in a moderate royal breeze, close hauled, 6 6-10 knots.

The *maximum* speed obtained with sail alone under the same circumstances, 1 8-10 knots.

The mean time occupied turning a whole circle ahead, 7½ minutes; ditto astern, 9 minutes.

Time occupied in reversing engines from full speed, 1¾ minutes.

Time elapsed from engines being ordered to be reversed until ship went astern, 2 minutes.

Time occupied in getting the steam up from cold fresh water, temperature 56°, 1 hour, 16 minutes; ditto from cold salt water, temperatura 62°, 1 hour, 15 minutes. In getting up the steam when her fires were banked up, from salt water, temperature 140°, 45 minutes.

Time occupied in raising propeller—*maximum*, 25 minutes; *minimum*, 15 minutes.

In lowering the propeller—*maximum*, 8 minutes; *minimum*, 5¼ minutes.

In lowering the funnel, 10¼ minutes; in raising it, 8 minutes.

At the measured mile in Stoke's-bay she went 6¼ knots.

THE "COURIER" STEAMER.—EXPERIMENTAL TRIP.

The *Courier* is an iron vessel, built for the New South Western Steam Company, by Mr. Mare, and fitted by Messrs. Maudslay and Field with engines on the much-approved annular plan of Mr. Joseph Maudslay, as also with the description of feathering paddle-wheel known as "Morgan's Improved," which this firm have for some time past adopted, as preferable, in their judgment, to any other. The vessel is of 439¼ tons, 170 feet long, and 23 feet beam; the engines are of 200 nominal, but more than 400 real horse-power; and the wheels of 20 feet diameter over all.

On Friday last this vessel made her first experimental trip. She started from Blackwall at 10.35′ A.M., went as far as the Mouse Light, and was moored at Blackwall again at 4.30 P.M. The distance is called 104 miles, and is stated to be made up thus:

	Miles.
Blackwall to Gravesend	21
Gravesend to the Nore	23
The Nore to the Mouse	8
	52
	2
	104

Assuming these distances to be accurately computed, and making no deductions from the time occupied, 5 h. 55 m. in all, for incidental hindrances, it follows that the vessel must have gone at the amazing *average* rate of not less than 17½ statute miles per hour. In returning (with the tide,) the 21 miles between Gravesend and Blackwall were said on board to have been actually performed in 59 minutes; but we had by that time closed our note-book, and though we have no doubt of the fact, we cannot bear our own personal testimony to it.. The greatest number of revolutions of the wheel per minute, noted by us was 40, with the steam at a pressure of 16 lbs. and vacuum of 26¾. The time occupied in going down to the Mouse, against the tide, was 3 h. 20 m., and in returning, with the tide, 2 h. 35 m.

RECENT AMERICAN PATENTS.

IMPROVEMENT IN THE PEN OR PENCIL CASE. *Albert G. Bagley.*

The patentee says,—"The ordinary pen or pencil-case is constructed with one tube or barrel, and the holder of the pen or pen-

Digitized by Google

cil, which slides in and out of it. This contrivance is found to be inconvenient, on account of its length, and the object of my invention is, to obtain the same length of pen-case, when extended, with the advantage of being not more than one-half of the ordinary length, when closed or slided in. This I effect by making my pen-case of two tubes or barrels, one sliding into the other, and the pen or pencil holder to slide within them."

METHOD OF IMPREGNATING TIMBER AND OTHER POROUS BODIES. *Peter Von Schmidt.*

Claim.—"What I claim as my invention, for the purpose of impregnating timber or any other porous substance by any desired fluid, and to encrust or char said wood, in a complete manner, in heated oil, is the following combination of the operations, viz., The steaming of wood in combination with exposing the same immersed in any desired fluid to a vacuum; further in combination with the application of high pressure by a hydraulic press pump; and, finally, if required, in combination with charring or encrusting by coal, the impregnated wood in heated oil, as set forth. All these operations are done in one and the same apparatus. By the different combined actions upon the wood, a perfect impregnation is accomplished, and by the encrusting or charring of the wood in heated oil, the timber so prepared is more lasting and durable than iron; therefore the combined actions upon the timber, as set forth, have the advantage over all other modes to saturate or kyanize timber which have been practised heretofore."

AN INSTRUMENT CALLED THE SAW-DRESSER, FOR RE-CUTTING THE TEETH OF SAW-MILL SAWS. *Apollos B. Spencer.*

A frame is so formed that it can be clamped to the saw, with a rest or die, that rests against the edge of a tooth, and made adjustable to suit different sizes. A cutting burr is hung in a secondary frame, which slides in the clamped frame, at an angle to correspond with the slope of the teeth, so that by sliding the secondary frame, and rotating the burr, the teeth will be cut.

IMPROVEMENT IN THE METHOD OF BREAKING, FLESHING, AND UNHAIRING HIDES. *George Welty.*

The patentee says,—"The nature of my invention and improvement consists in a new mode of working hides by power-machinery, instead of hand: that is to say, taking the hides, after being properly soaked, and subjecting them to the action of a series of parallel serrated plates (for breaking and fleshing the hides,) placed on the periphery of a revolving cylinder, arranged immediately above a revolving drum, for sustaining, raising, and carrying forwards the hides, between the cylinder and drum—the hides being introduced from an inclined table and roller—the effect of said serrated plates being to break and flesh the hides, as they pass between the said cylinder and drum."

IMPROVEMENT IN THE BLACKSMITH'S TUYERE. *Charles W. Grennis.*

Claim.—"What I claim as my invention, is causing the blast to descend, and then ascend, before leaving the tuyere, by curving the orifice down, and then enlarging it upwards, by which I obtain an elevated blast, and prevent the tuyere from clogging, in combination with a valve placed below the draught, so that on elevating it the draught will be contracted from below."

MACHINE FOR PUTTING BOOTS AND SHOES ON THE LAST. *Silas Hart.*

The patentee says,—"The nature of this invention and improvement consists in contracting and expanding the arms containing the jaws for gripping the edges of the upper of the boot or shoe, by means of a slide that embraces or encircles the arms, said arms being moved towards or from the last, simultaneously with the operation of turning the male screw in a female screw in the centre of the nut, to which they are connected, by which the angle of the arms with the screw is diminished by lasting the upper, and increased in unlasting it, by reversing the operation of the screw; thus removing the objections existing in the use of the machine, where the arms are expanded and contracted by a separate screw, managed at right angles to the main screw, and possessing the advantage of drawing the edges of the leather inward towards the shank, and outward towards the side simultaneously, at the single operation of turning the screw against the last."

IMPROVEMENT IN THE VALVES OF STEAM-ENGINES. *H. Olney, J. H. Wheipley, and D. G. Raven.*

Claim.—"What we claim as our invention, is the method of inducting and educting steam to and from the cylinder of one engine by means of a hollow piston-rod in two parts, connected to and united by a piston, in which are placed induction and eduction slide-valves, operated by thin projecting ends striking against the heads of the cylinder, as the piston approaches them in performing its reciprocal vibrations—the induction valve being in connection with one portion of the piston-rod, and the eduction valve with the other portion of the same."

IMPROVEMENT IN THE EVER-POINTED PENCIL. *A. G. Bagby.*

Digitized by Google

Claim.—"What I claim as my invention, is the mode herein set forth of forming a bottle or receptacle for surplus leads in the inner cylinder, within which the traveller works, by introducing slips of sheet metal or tubes, to keep the leads from obstructing the passage of the traveller, and to form compartments for the leads to be deposited, in combination with a cap, to screw or slide on the end of the cylinder, so as to keep the leads in the compartments."

IMPROVEMENT IN THE STEERING-WHEEL. *R. C. Holmes and J. J. Springer.*

The patentees say,—"The nature of our invention consists in the employment of two grooved rollers, mounted in appropriate bearings, one above the other, on the helm, the upper one being on the shaft of the tiller-wheel; and mounting the tiller-rope, by first attaching one end of it to one side of, and near the extremity of, the helm, passing it through a block attached to the side of the vessel, then through a block attached to the same side of the helm, then over the upper drum, and in the first groove, then under the lower drum, then around the upper drum, and in the second groove, then around the lower drum, and in the second groove, and so on to the end, each time crossing the rope, to insure the bight thereof, and then from the upper drum to a block attached to the side of the helm, and just opposite to the attachment of the rope, on the other side, and thence carrying the rope through a block at the side of the vessel, and then tying the ends to the helm, at a point just opposite to the block on the other side; so that, by this arrangement of the grooved drums, and the disposition of the tiller-rope, it (the rope,) is prevented from slipping and over-riding, and, at the same time, it is prevented from making slack, as the helm vibrates, for the slack is taken up on one side as fast as it is made on the other, and the rope is also prevented from chafing."

FOR AN IMPROVEMENT IN THE ESCAPEMENT FOR WATCHES. *Charles B. Jacot.*

Claim.—"I do not claim to have invented a new watch; but I do claim as new, and of my own invention, and desire to secure by letters patent, the application of a roller on the balance-staff made of ruby or agate, or other proper material, fitted with a groove to take the end of the lever, and the combination therewith of a crown or central wheel, fitted or constructed with conical teeth having radial axes, and acting conjointly with pallets fitted to coincide with the wheel-teeth; the whole constructed and operating substantially as described."

IMPROVEMENTS IN LOCOMOTIVE STEAM ENGINES. *Rose Winans.*

Claim.—"What I claim as my invention, is the employment of wheels of small size, with wrought or soft iron flanches, in combination with an engine having six or eight driving-wheels with axles, parallel to each other, and accommodating itself to curves and turnouts, and having the power applied to all the axles by connecting-rods and cranks."

IMPROVEMENT IN FISH-HOOKS. *Theodore F. Engelbrecht and G. F. Skiff.*

This improvement consists in jointing to the stem of a fish-hook another hook, which is forced down by a spring. When set for fishing, the extra spring hook is held up by a sliding catch connected with the line, and when the main hook that carries the bait is pulled by the fish, this liberates the spring hook, which catches on to the fish.

TYRE FOR RAILROAD WHEELS. *D. Saunders, J. G. Bisset, and S. Saunders.*

The following is the mode of procedure;—A pile of iron and steel is made as follows—first a large bar of iron, then a thin bar of steel, then another bar of iron, the latter being thin, and serving only as a protection to the steel from being burnt in the process of welding, the whole is then welded. The bar is then passed through a series of rollers giving the required shape to the tyre, shrunk on to the wheel, and the thin plate of iron turned off to expose the steel to the surface.

RAILWAY BUFFERS.

Sir,—I would beg to suggest the propriety of having railway buffers at one end of each carriage, instead of at both ends, and letting them abut upon a perfectly plane surface. The rods, &c., must, of course, be made of proportionate strength; but the buffers would have no tendency to ride, which they now have, when the rods of those in contact are not in the same line.

I am, Sir, yours, &c.,
S. Y., an Engineer.

October 12, 1847.

[Buffers with plane or flat surfaces were tried long ago, and are still in use for goods' wagons; but it has been found that they have just the same tendency to ride as others. ED.]

HOW TO CLEANSE MEERSCHAUM PIPES.

Sir,—The objection raised against the cleansing of meerschaum pipes, by a correspondent in the *Mechanics' Magazine* for April, is completely overruled by the following method:—Apply the head of the pipe to any small cock connected with a steam-boiler, then turn the steam through it (this

Digitized by Google

must be done without the tube); afterwards apply the tube in like manner.

After this operation, they smoke much sweeter than when new.

I am, Sir, yours, &c.,
W. KENT.

Bury, August 17.

LIGHTING BY ELECTRICITY.

The Literary and Philosophical Society of Sunderland—one of the most popular, flourishing, and useful Institutions in the north of England—gave a public soirée last week, at which the great attraction of the evening is stated to have been an exhibition of Mr. Staite's new mode of lighting by electricity. We extract the following paragraph on the subject from the *Newcastle Guardian*:

"The light, which was of astonishing brilliance and beauty, was placed under an air-tight glass vase. When the gas was turned down, it sufficiently lighted the spacious building, and bore the closest resemblance to the great orb of day of any light which we ever witnessed. The electric light was afterwards exhibited in a vessel of water with equal success, the exhibitor humurously remarking, that it was thus proved quite possible "to set the Thames on fire." Mr. Staite stated that this light is economical as well as beautiful—the cheapest, as well as the best, for all practical purposes. It seems almost needless to add that this marvellous invention was hailed with rapturous plaudits."

In a lecture afterwards delivered, Mr. Staite gave the following comparative statement of the expense of the electric light, as compared with other modes of lighting:

"With a battery consisting of forty small cells in series, the light was equal to 380 tallow candles, 300 wax candles, or 64 cubic feet of gas, this being effected by the consumption of little more than three-quarters of a pound of zinc per hour. The relative cost was by the electric light 1d., gas 6d. to 8d., tallow candles 7s. 6d., and wax candles 12s. 6d. per hour—so that there was no light so cheap, as well as none which exhibits such pure and brilliant results."

The apparatus employed by Mr. Staite at Sunderland is, we believe, on a plan somewhat different from those formerly patented by him, and described in our pages (see vol. xlv., p. 160, and vol. xlvi., p. 621;) and forms the subject of a new patent, which has not been yet specified.

INQUIRIES AND ANSWERS TO INQUIRIES.

Tolls on Common Road Steam Carriages.—"Will the Editor, or some of the correspondents of the *Mechanics' Magazine*, be so kind as to inform me why our road commissioners have ordered that every steam-carriage passing through the toll-bar of a common road should have to pay two shillings? I have long had a project in view of making a small private steam-carriage to carry two persons. Now, how should I be placed with regard to toll, supposing the affair weighed about five or six cwt.? Should I have to pay this enormous sum for my novelty, for so small and light a vehicle; or would it be liable to no more than the reasonable and ordinary toll of other conveyances of equal weight? Is there not a lawful means of avoiding this imposition? Supposing the carriage were to stop within 100 yards before it came to the bar, and be pulled through by a lad, until it was 100 yards on the other side, would not this avoid all claim? It is rather a shabby expedient; but considering that, to go eight miles on a common road it is a serious matter to have to pay twelve shillings, at the very least—three-fourths of which sum being an improper demand, and out of all reason for a small pleasure steam-carriage,—a demand which would at once put a stop to any engineering project of the kind, even were the invention ever so plausible. I will feel obliged if some one will give me a little information on this subject, which is of considerable importance to the public at large, in these days of advancement in engineering accomplishments."—*An Enquirer, Leeds.*

[The toll is exacted, no doubt, under the authority of some existing Act of Parliament, and could not be evaded in the way proposed. The only remedy is to get the law repealed. ED.]

Specific Gravities.—"A wagers with B that two pints do not always make a quart." A has won. For example, a pint of water and a pint of sulphuric acid will not make a quart, and the "half-and-half," in this case, make a whole, which is less than either half doubled. The reason is, that the constituent atoms or particles of different bodies are not all of like form and magnitude—a truth not demonstrable to sight or touch, yet plainly deducible from many observed facts.

Wire Ropes.—"D. T.," though a "practical miner," seems to be but indifferently informed on this subject. It has never been clearly ascertained who first suggested the idea of using metallic wires instead of yarns of fibrous material for making ropes. For anything that has yet appeared, the French are entitled to the credit. The late Sir John Robison saw wire cordage used in the machinery of the Opera at Paris, in 1822; and, in the report on Harris's Lightning Conductor, laid before the Lords Commissioners of the Admiralty in 1839, it was stated that wire ropes had been used as lightning-conductors in the French navy; nay, a piece of wire rope, obtained from the frigate *Calypso*, when at Chatham in 1822, was actually produced for the inspection of the committee. Experiments on the subject of their application as ropes for mines were made at Freyberg, in Saxony, in the year 1827, but

Digitized by Google

it was not till 1834 that they were successfully used in the mines of the Harz Mountains. The suggestion of the plan then adopted, is due to M. Albert, director-in-chief of the Hanoverian mines. In the course of a short time wire-ropes completely superseded the hemp ropes and chains used in those mines. In France a great many suspension-bridges have been made during the last twenty years; the suspension-cables, being formed, however, simply of parallel straight wires, bound together by wires lapped round them. Descriptions of these were published in this country in 1825, and several are described in "Drewry on Suspension Bridges," published in 1832. In 1839, Mr. Andrew Smith took out a patent for improvements in the manufacture of ropes, which were to be made in a similar manner to *common* hemp ropes, by *twisting* wires together into strands and ropes. Ropes on this plan were for some time used on the Blackwall Railway, but have now been superseded by those patented by Messrs. R. S. Newell and Co., of Gateshead, in 1840 and 1843; which are made by machinery invented for the purpose, and by which a motion is given to each wire, so as *to prevent* its being *twisted*, while the wires, generally six in number, are laid symmetrically round a core, to form the strand; and the strands (also generally six) round a core to form the rope, so that the wires are all of the same length, and are subjected to an equal strain. By this means *the greatest possible* strength is obtained from the material employed.

Solution of Silk.—"Some time ago it was announced, that a method of dissolving silk had been discovered abroad; and I see, by the newspapers, that an attempt is now making to coat cotton thread with a solution of silk, so as to give it the appearance of silk. Can any of your correspondents give any information as to the liquid employed? It is a subject well worthy of attention."—*C. C. C. C., Oct.* 30, 1847.

NOTES AND NOTICES.

Perpetual Motion.—A correspondent of the *Midland Counties Herald*, says, "a poor framework knitter, of Hinckley, named Joseph Hutt, has, after twenty years' application and study, completed a machine which he calls a 'self-moving machine or 'perpetual motion.' He set it in motion on the 26th August last, since which time it has continued to work with the greatest regularity. The motions of the machine are both quick and powerful, and may be greatly increased and applied to any purpose. It does not require the aid of steam or any other power to keep it in motion, having one continual and regular movement of its own. Hutt, who is a poor man, is anxious to obtain assistance to enable him to test still further the value of his invention." The best thing which the friends and neighbours of this "poor man" could do for him would be, to make him a present of some standard work on mechanics, (say Gregory or Moseley,) from which he would learn that the object he is aiming at is a *positive impossibility*. And, if it can be done, without danger of offence, or undue excitement, we would recommend them to couple with it a copy of Beattie "On Truth."

Fauvelle's Boring Apparatus, which attracted so much attention at the Southampton Meeting of the British Association two years ago, was referred to a committee of the late Italian Congress of Science, at Venice, who made a report upon it, of which Mr. William Pole gives the following account (*Mining Journal*, Oct. 30): "The commission appointed upon the subject of Artesian wells announced, they had this month commenced, and repeated with the happiest result, the experiments for which a certain grant was set aside—namely, to prove the practicability of Fauvelle's method of boring—extracting the material excavated by the injection of water, without withdrawing the auger. Details were given of the experiments, and the result appeared to justify the opinion, that, where the strata were not absorbent, the method alluded to rendered the operation more easy, expeditious, and economical."—For details of the process see *Mech. Mag.*, vol. xlvi., p. 308.

The Hudson's Bay Company's Arctic Expedition—In July, 1846, the Hudson's Bay Company despatched an expedition of 13 persons from Fort Churchill in Hudson's Bay, under the command of Dr. John Rae, for the purpose of surveying the unexplored portion of the Arctic Coast at the north-eastern angle of the American continent. This expedition has now returned, after having traced the coast all the way from the Lord Mayor's Bay of Sir John Ross to within a few miles of the Straits of the Fury and the Hecla—thus proving Sir John Ross to have been correct in stating Boothia Felix to be a peninsula, and a portion of the American continent.

Simpson's Submerged Horizontal Side-Propellers.—Since the account of these given in our first article was in type, the *Albion* has made a second trip, which is described to us as having been even more successful than the first. The Earl of Dundonald and Admiral Sir Charles Malcolm were present on the occasion, and expressed a highly favourable opinion of the invention. More in our next.

New Application of the Centrifugal Governor.—Among the latest fruits of American ingenuity, is a horse-power to which a centrifugal governor (like that used in steam-engines) is attached, which of its own accord pulls up the horses when they go too fast, and begins whipping them the moment they loiter.

Etherization of Old Date.—In Middleton's tragedy of "Women Beware Women," published 1657, there is the following passage:

"I'll imitate the pities of old surgeons
To this lost limb, who, ere they show their art,
Cast one asleep; then—cut the diseas'd part."

Railway Speed.—The railway papers are boasting of a man who lately travelled 713 miles in 26 consecutive hours. This is idle, after it has been shown that a speed of a mile a minute is quite *within* the mark. Had the traveller done twice 713, or 1560 miles during the 26 hours, that would have been something to talk about.

Clean Hands—Soft Hands.—Lewenhoeck mentions the case of a master carpenter, "who was likewise a diligent workman," whose hands were "as soft in the palms as if he had never been used to labour." The philosopher asked him how this was? The man replied—"I wash my hands ten times a day, at least, for I hate to see them foul."

Second Tunnel Bridge.—One of these wonders of the age, the Tubular Bridge over the Conway, is so far advanced towards completion, that its erection is expected in the course of the ensuing month. The site of the bridge is on the south side of Telford's "suspension-bridge," close to the wall of the Conway Castle Bridge (also by Telford.) It will be precisely of the same description as the one to be thrown across the Menai Straits, the Conway Bridge consisting of two tubes or tunnels (one for the up and the other for the down line of rail,) each 400

Digitized by Google

feet in length. It is rectangular in form, consisting entirely of sheet iron, one inch in thickness. The inside, through which the trains are to pass, is 24 feet high and 15 feet wide. The outside height is much greater, being about 30 feet. The top is of two thicknesses of corrugated metal, forming a series of circular tubes of about three feet in diameter. This form is considered to offer the greatest resistance to compression. The sides are of sheet iron of one thickness; the bottom has a double thickness, three feet apart, connected by intermediate longitudinal ribs, so as to give the necessary stiffness for the carriages to pass over. The whole mass, weighing upwards of 1,000 tons, will be placed on the abutments at once. The place where it is being constructed is on a huge timber platform, in a curve of the Conway, a few hundred yards from the intended site of the bridge. Immediately the tube is completed, with the aid of a flood tide and pontoons, it will be raised so as to admit of the platform on which it is erected being carried away.—*Shrewsbury Chronicle*

Theory and Practice.—The celebrated Colin Maclaurin, and scarcely less distinguished Dr. Desaguliers, were applied to by the City of Edinburgh to calculate the quantity of water which might be supplied to that city by a train of pipes of certain given dimensions, The quantity actually obtained was only about one-eleventh of Maclaurin's calculation, and one-sixth of that of Desaguliers.

WEEKLY LIST OF NEW ENGLISH PATENTS.

Meyer Meyer, of Artillery-place, Finsbury, Middlesex, for certain improvements in the manufacture of umbrellas and parasols. November 2; six months.

James Walker, of Glasgow, gentleman, for improvements in weaving. November 2; six months.

Thomas Dunn, of the Windsor Bridge Iron Works, Manchester, for improvements in the manufacture of railway wheels and axles, and in machinery and apparatus for placing carriages on to a line of rails, for removing them from one line of rails to another, and for turning them. November 2; six months.

William Boulnois, of Baker-street, Portman-square, Middlesex, gentleman, for improvements in draught harness. November 2; six months.

Jean Charles Victor Coullon, of Auxerre, France, for improvements in propelling vessels. November 2; six months.

Anthony Bernhard Von Rathen, of Putney, Surrey civil engineer, for improvements in obtaining and applying motive power. November 2; six months.

William Longmaid, of London, gentleman, for improvements in the manufacture of alkali and chlorine. November 2; six months.

Thomas Langton, of Bullwell, near Nottingham, for improvements in the manufacture of knitted fabrics. November 2; six months.

James Murdoch, of Staple-inn, Middlesex, for an improved capsule, or small case for protecting matters inclosed therein from the action of the air, and an improved material to be used in the manufacture of the said capsules. November 2; six months.

Thomas Hancock, of Stoke Newington, Middlesex, Esq., for improvements in fabrics elasticated by gutta percha or any of the varieties of caoutchouc. November 2; six months.

Richard Laming, of Clichy la Garonne, France, for certain improvements in manufacturing and purifying coal gas, and in treating a residual product of such manufacture; also improvements in preparing materials to be used in the purification of coal gas. November 4; six months.

Charles Low, of Rosebery-place, Dalston, Middlesex, gentleman, for improvements in the manufacture of zinc, copper, tin, and other metals. November 4; six months.

Cyprien Marie Jessie Du Molay, of Paris, gentleman, for improvements in inlaying and coating metals with various substances. November 4; six months.

John Lawson, of Paisley, North Britain, for improvements in machinery for separating burs, seeds, and other matters from wool, cotton, and other fibrous substances. November 4; six months.

George Wells, of 7, Penton-place, Walworth, Surrey, for a machine for the purpose of causing communication between the guards and engine-drivers of railway carriages whilst travelling on railways, and also for communication between vessels at sea and the shore, and for other similar purposes, and which invention it is intended to call "An Atmospheric Signal by Land or Water." November 4; six months.

Jean Marie Durafour, of Lyons, France, for a new fastening, or improved system of lacing without eyelet-holes. November 4; six months.

Joshua Procter Westhead, of Manchester, for improvements in the manufacture or treating of India-rubber. November 4; six months.

James Pedder, of New Union-street, Middlesex, engineer, for certain improvements in steam-engines, and in propelling. November 6; six months.

Robert Davison, of New Broad-street, London, civil engineer, and William Symington, of the same place, civil engineer, for certain improvements in the application of heat to the preparation, desiccation, and preservation of bread stuffs, confectionary, pulse, meats, vegetables, and other edible substances. November 6; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Designs.
Oct. 30	1245	H. and R. Heywood	Burslem, Staffordshire, and 115, South Wharf, Paddington	Heart-shaped drain-pipe.
,,	1246	John Randolph Remington and William Simonett	Kennington	Portable gas water-lamp.
Nov. 1	1247	George Chambers & Co.,	Studley, Warwickshire	Crotchet needle.
2	1248	Joseph Burdett	9, Gloucester-street, Queen-square	Expanding sofa-bedstead.
,,	1249	J. Guise	75, Margaret-street, Wilmington-square	Glass deflector for gas-burners and lamps.
,,	1250	John Henry Sadler	Brentwood, ironmonger	Candle-guard.
,,	1251	John & James McRae,	17, Ave-Maria-lane, City	"Porte Graphite," or mechanics' companion.
3	1252	Richard Thompson Furness	40, New Church-street, St. Marylebone	Glass rotary ventilator.

Digitized by Google

Gutta Percha.

October 1, 1847.

THE GUTTA PERCHA COMPANY, in requesting the attention of the Public to the accompanying Testimonials, have great pleasure in stating that the steadily increasing demand for the PATENT GUTTA PERCHA DRIVING BANDS justifies the utmost confidence that they are fully approved.

Their durability and strength, permanent contractility and uniformity of substance—their insusceptibility of injury from contact with Oils, Grease, Acids, Alkalies, or Water, and the facility with which the single joint required can be made in Bands of an indefinite length, render them superior for almost all working purposes, and decidedly economical.

Catchets, Tubing of all sizes, Bougies, Catheters, and other SURGICAL INSTRUMENTS; MOULDINGS FOR PICTURE-FRAMES and other decorative purposes; WHIPS and THONGS, TENNIS, GOLF, and CRICKET BALLS, are in a forward state of manufacture, and will be very shortly ready for sale.

All orders forwarded to the COMPANY'S WORKS, WHARF-ROAD, CITY-ROAD, will receive immediate attention.

Haslingden, September 4, 1847.

Dear Sir,—We have now been using the Gutta Percha Straps for the last eight months, and have great pleasure in saying they have answered our most sanguine expectations; and we may add, that some of our machines which required a 12-inch leather strap, and which almost daily required to be repaired, we have been turning the same with the Gutta Percha Straps 10 inches only for the above-named period, and now find them as good as the day they were first applied.

We remain, yours respectfully,

W. & R. TURNER.

To S. Statham, Esq., Gutta Percha Company.

Atlas Works, Manchester, Sept. 1, 1847.

Sir,—In reply to your inquiry as to the result of our experience with the Gutta Percha Straps, we have great pleasure in stating that the advantages they possess are so very manifest as to induce us to apply them in almost every instance where new straps are required.—We are, Sir, very respectfully,

SHARP, BROTHERS.

Samuel Statham, Esq.; Gutta Percha Company.

Bridgewater Foundry, Patricroft, near Manchester, Sept. 3, 1847.

Sir,—In reply to your inquiry respecting how we like your Gutta Percha Machine Straps or Driving Belts, although we have not had quite so much experience in the above-named use of Gutta Percha as we hope to have, so far as we have employed it, it has given us general satisfaction. The beautifully straight and regular manner in which it runs on the pulleys, especially on our cone or speed pulleys, is a strong recommendation in its favour; and although we are inclined to think it does not take so fast a grip on the pulley as leather, yet there is ample hold for all general purposes. We shall continue to use it and to give it our best attention, so as to learn how to employ to best advantage the many excellent qualities it possesses over the ordinary leather belts.

NASMYTH, GASKELL, & CO.

S. Statham, Esq., Gutta Percha Works, London.

Manchester, 18th June, 1847.

Dear Sir,—We beg to inform you that we have now had the patent Gutta Percha Bands or Straps in use for more than six months. For tube frames we consider them very much superior to anything we have tried before. They also do very well as open straps for mules, throstles, looms, &c.

We are, Sir, yours respectfully,

THOS. DODGSHON & NEPHEWS.

Mr. Samuel Statham, Gutta Percha Company.

Wellington Mills, Stockport, 4th September, 1847.

Gentlemen,—We have much pleasure in bearing our testimony to the valuable qualities of the Gutta Percha for driving bands. We have found it answer exceedingly well in most cases where we have tried it, and we think it has only to be made known to ensure its very general use.

We are, Gentlemen, yours obediently,

HOLE, LINGARD, & CRUTTENDEN.

To the Gutta Percha Company, City-road, London.

Tottington Hall, near Bury, Lancashire, September 3, 1847.

Dear Sir,—Your letter of the 31st August is to hand, and in answer respecting the use of your Gutta Percha Bands, I cannot give you a better proof of our approval of them in preference to leather straps, than having given an order for another to your partner, yesterday, to be in readiness in case of accident. They are decidedly preferable to the old straps; and we can recommend them with the greatest confidence to any person for Driving Straps.

For HALL & GORTON, THOMAS GORTON.

S. Statham, Esq., Gutta Percha Company.

Brewery, 16th September, 1847.

Gentlemen,—We have much pleasure in repeating our testimony to the very great improvement effected by the use of Machinery Bands made of your material instead of leather: the stoppage of parts of our works, through the failing of the leather straps, used to be of daily occurrence, causing great inconvenience and expense. With this annoyance we are now never troubled, and are assured by our superintendent that the advantage of using your material is surprising, as regards economy and saving of trouble. We confidently recommend it to machinists and factories for general adoption.

TRUMAN, HANBURY, BUXTON, & CO.

To the Gutta Percha Company.

Patent Gutta Percha Soles for Boots and Shoes.

The capabilities of the GUTTA PERCHA SOLES FOR BOOTS AND SHOES having been extensively and satisfactorily tested, we can unhesitatingly recommend the material prepared for the purpose, its merit having been acknowledged by all who have worn it. Indeed, experience has proved that Gutta Percha Soles wear twice as long as leather, with great additional personal comfort, and they remain perfectly impervious to wet until quite worn through.

23, Southampton Row, 1st Sept., 1847.

Gentlemen,—I write to thank you for allowing me to use the new PATENT GUTTA PERCHA SOLES. I felt annoyed at not being allowed to use them from the time I had first worn them, namely, from last October, but am not sorry now, because I can speak confidently of their advantages over leather soles. I made the first pair last October, and wore them eight months before I wore the soles through. I had them heeled six times, and one pair of extra fronts I put to the same soles. *I only kept the one pair in wear to see how long they would last.* I will never wear another leather sole so long as I can get GUTTA PERCHA SOLES, and I walk from 12 to 20 miles a day.

C. WRIGHT, Boot and Shoe-maker.

To the Gutta Percha Company.

9, Gloucester Row, Hoxton, 5th July, 1847.

Sir,—I beg to thank you for the boots with GUTTA PERCHA SOLES which I had from you on the first of the year. I have had them in constant use for nearly five months, the greater portion of that time being the most inclement period of the year; and from my occupation as a general post letter-carrier, you may be sure that they have had

Digitized by Google

more than a common fair trial, and the Gutta Percha seems now as firm and as little worn as on the first day. W. HUTTON, G. P. O. Letter Carrier.

To E. Granville, Esq., Gutta Percha Works.

28, St. John-street, August 25th, 1847.

Gentlemen,—It gives me great pleasure to acquaint you that the Gutta Percha Soles I had from your Works have answered the purpose admirably, as I can fully testify, having had them in wear six months, during the winter, in Smithfield-market, and have not been subjected to the annoyance of wet feet, as is often the case with leather soles, and, in my opinion, they wear three times as long.

H. I. TARLING.

To the Gutta Percha Company.

N.B.—The above Soles, which are not worn out, may be seen at the Gutta Percha Company's works.

No. 3, Union place, New-road,

Dear Sir,

I have worn the Gutta Percha Soles for nearly a year, with much satisfaction and comfort: in wet and cold weather they keep the feet perfectly dry and warm—are pleasant to wear, and I have found them more durable than leather.

I am, Dear Sir, yours faithfully,

W. GORTON.

To the Secretary of the Gutta Percha Company.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Patent Bells.

MESSRS. MEARS beg to call the attention of the Trade and the Public generally to these articles, which they are now prepared to supply in any quantity and variety. The composition is of a new metal, called the Union Metal, and the bells are of very beautiful tone, and cheaper than those made of the ordinary bell metal. Orders received at the Bell Foundry, Whitechapel, for house, cattle, and other bells.

Just Published, in Foolscap 8vo., Price 5*s.*; or, as a Pocket-book, 7*s.*,

A CATECHISM of the STEAM-ENGINE. By JOHN BOURNE, Esq., C.E., Editor of the *Artizan*.

Also, in Foolscap 8vo., Price 4*s.*,

AN ESSAY on the AIR-PUMP and ATMOSPHERIC RAILWAY; Elucidating Mr. Robert Stephenson's elaborate Report on Atmospheric Propulsion. By WILLIAM TURNBULL, Author of "A Treatise on the Strength of Cast Iron," &c., &c.

JOHN WILLIAMS & Co., Architectural and Engineering Publishers, 141, Strand.

NOTICES TO CORRESPONDENTS.

J. W.'s *problem has already appeared in another journal, from the correspondents of which it will, no doubt, receive due attention.*

N. C. D.—*Curious and interesting, but requiring more space than we can afford.*

Communications received.—*P. B.—Handsaw—L. L.—Alpha—Paul Plain.*

Erratum.—*In the account of the improvements in guns and cartridges, given in our last number, for* Jager, *read* Jaeger. *The inventor is Dr. Jaeger, a physician of Vienna.*

CONTENTS OF THIS NUMBER.

Description of Simpson's Submerged Horizontal Side-propellers—(*with engravings*) 443
On the Employment of Heat as a Motive Power. By A. H.—(Continued) 446
Chapters on Analytical Geometry. By James Cockle, Esq., M.A., Barrister-at-law.—Chap. VIII. Hyperboloid of Two Sheets 451
Necessity of Inquiry into the State of the Different Branches of our National Industry. 452
The Mixed Gauge and Gloucester and Cheltenham Experiment 453
Mr. Gibbon's Patent Improvements in Trussing-beams and Girders—(*with engravings*) ... 454
Mr. Samuel's Railway Express Engine—Light Engines for Light Weights 455
Boiler Explosion at Rochdale 456
The Atmospheric Railway System 457
Mr. Robert Hunt's New Division of the Sun's Rays—Light, Heat, Actinism 457
American Tapestry Carpeting 458
The Screw Guard Ship "Blenheim" 458
The "Courier" Steamer—Experimental Trip... 459
Recent American Patents 459
Railway Buffers 461
How to Clean Meerschaum Pipes 461
Lighting by Electricity 462
Inquiries, and Answers to Inquiries 463
Notes and Notices 463
Weekly List of New Patents 464
Weekly List of Articles of Utility Registered. 464
Advertisements 464

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 165, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh

Digitized by Google

Mechanics' Magazine,

MUSÉUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1266.] SATURDAY, NOVEMBER 13. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166 Fleet-street.

BROOMAN'S PATENT IMPROVEMENTS IN TURN-TABLES.

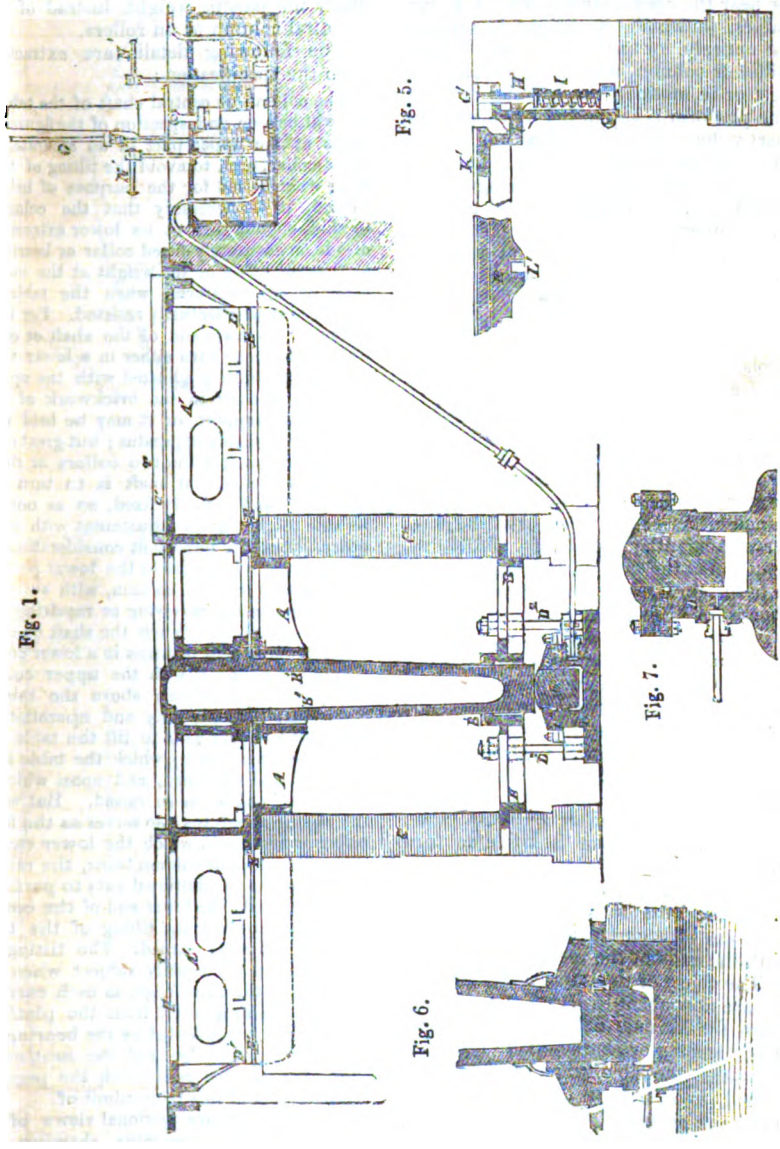


Fig. 1.

Fig. 5.

Fig. 7.

Fig. 6.

Digitized by Google

BROOMAN'S PATENT IMPROVEMENTS IN TURN-TABLES.

[Patent dated 29th April, 1847; Specification enrolled 29th October, 1847. Invention communicated by a Foreigner residing abroad.]

There are four kinds of turn-tables at present in use: first, those supported, when at rest or in motion, by rollers at or near their peripheries; second, pillar-tables, in which the weight is supported entirely, or principally by a central pillar or column, whether the table is at rest or in motion; third, tables in which the platform is supported by rollers, and partly by a column, pillar, or central shaft; fourth, tables which are depressed or raised for the purpose of being turned, and which, when in the act of turning, are supported on a central point or on rollers, and which, when at rest, are sustained at or near their outer edges on fixed bearings, as wedges or cams, but which wedges or cams have to be shifted when the table is to be turned, and again replaced to render the table fit for the passage of a train.

A general defect of these turn-tables is, that, when passed over rapidly by heavy carriages they are liable to tilt or to deflect, which arises from their not being laid on a sufficiently firm basis, and sustained either continuously or at short intervals under the line of rails. Unless the platform of the turn-table is supported so as to sustain the great weights and sudden shocks of heavy engines and tenders, with their attached carriages passing in succession over it, without any sensible tilting deflection or depression in any part, the table becomes dangerous, and the trains cannot pass across it in safety without a slackening of speed or other precautions. Again; from the unequal bearings to which tables supported on rollers and other similar contrivances are subject, the platform is liable to turn slightly as the weight comes suddenly upon it, the effect of which turning is to throw the rails on the platform of the table out of accurate adjustment or line with the rails of the road.

The object of the improvements which we are now about to describe is, to obviate the various defects above stated. Their leading or characteristic feature is this—that the table, when required to be turned, is raised by the pressure of a fluid, and sustained whilst being turned upon the fluid by the pressure of which it was so raised, and when turned to the required position, lowered by withdrawing that pressure, and that the table, when not required to be turned, rests on continuous or solid stationary bearings under the passing weight, instead of on a central column or on rollers.

The following details are extracted from the specification:

The column or central shaft of the table, (as will be seen on inspection of the figures,) turns at the upper part in an accurately-fitted collar, and, to avoid the tilting of the table when raised for the purpose of being turned, it is necessary that the column or shaft should turn at its lower extremity also in an accurately-fitted collar or bearing, so that the effect of the weight at the outer edge of the platform, when the table is raised, may be effectually resisted. For this purpose, the lower end of the shaft or central column may turn either in a lower ring or collar accurately adjusted with the upper collar, and fixed in the brickwork of the continuous support, or it may be held and turn in the raising apparatus; but great care must be taken that the two collars or rings in which the central shaft is to turn are accurately and securely fixed, so as not to be able to get out of adjustment with each other. Another important consideration is, the having ready access to the lower part of the shaft or central column, with suitable arrangements for removing or repairing the raising apparatus. When the shaft or central column is held or turns in a lower collar accurately adjusted with the upper collar, and placed immediately above the raising apparatus, the only duty and operation of the raising apparatus is to lift the table and furnish the bearing by which the table is to be raised and sustained, and upon which it is to be turned when so raised. But when the raising apparatus also serves as the fixed collar or bearing in which the lower end of the central shaft or column turns, the raising apparatus has an additional duty to perform, namely, to hold the lower end of the central shaft, and prevent the tilting of the table when it is being turned. The tilting to which tables are usually subject when the weight is at the outer edge, as each carriage comes on to or goes off from the platform of the table, is prevented by the bearings at or near the outer edge and the continuous supports under the rails which the peculiar arrangements of this table admit of.

Figs. 1 and 3 are sectional views of the table and raising apparatus, showing also the force or injecting pump and main bearers or girders of the platform of the table, of

Digitized by Google

Fig. 4.

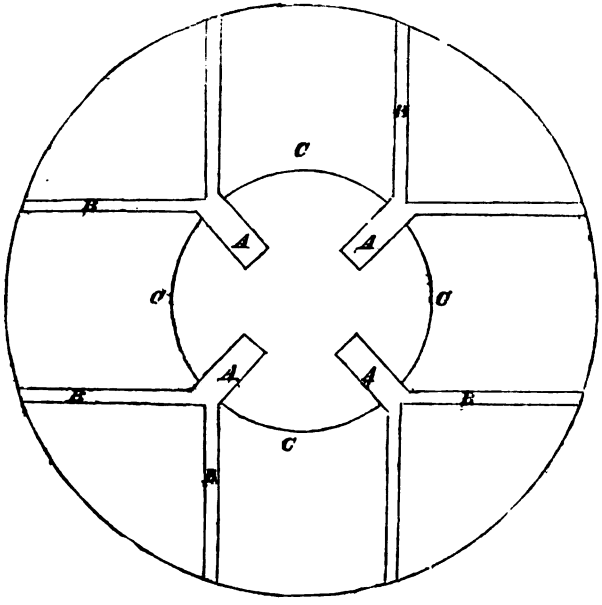
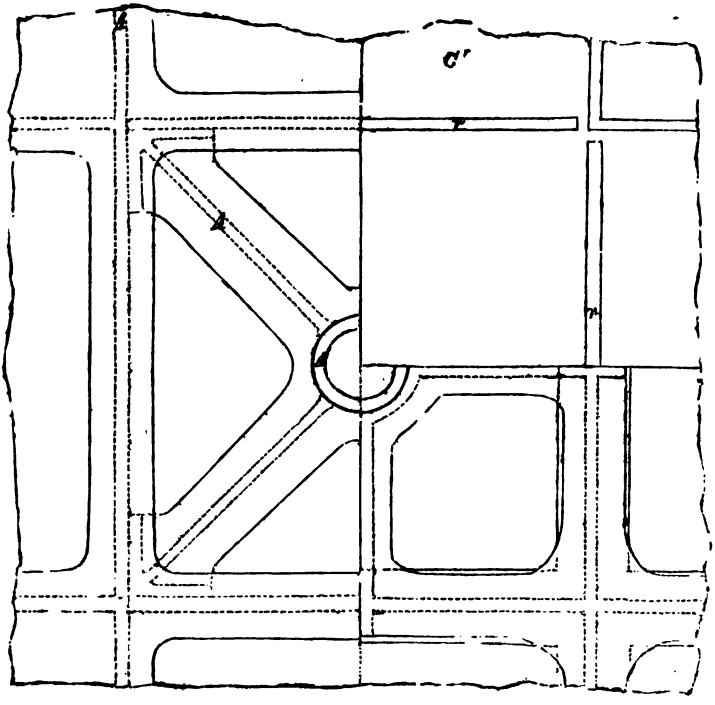


Fig. 2



x 2

Digitized by Google

which figure 2 is a plan. Figure 5 is a sectional view, showing a stop for the purpose of ensuring the table, after being turned, stopping in such a situation that the rails on the platform of the table may be in accurate adjustment with the rails of the line.

The framing and construction of the platform of the table may be made according to the pleasure of the engineer, provided that the main bearers or girders, A^1A^1, (as shown in figs. 1 and 3,) are sufficient to sustain the weight of the carriage, with its load, without deflection at the outer edge when the table is lifted for the purpose of being turned, and that the platform is firmly connected with the central column or shaft, B^1. It will be observed that the main bearers or girders of the table are sustained either continuously under the lines of rails, *rr*, or as on a square in the middle of the table (as shown in figure 2,) according to the width of the gauge, and also near the edge of platform C^1, under the points, D^1D^1, over which the trains pass on and off the table in the ordinary working of the railway. Thus there will in all cases be a firm support near the outer edge of the table and across the table in the line of the rails of the railway. Fig. 4, shows a plan of foundations, which may be convenient in some cases; the projections, AAAA, at the junction of the walls, BB, presenting buttresses, upon and into which corresponding projections of the upper and lower collars, or the raising apparatus, afterwards explained, may be set. This arrangement of the foundations may be found convenient for railways of the broad gauge; it also has the advantage of giving more room in the central pit for the raising apparatus; the access to which may be from above, through the platform, either directly into the central pit or through an arch in the circular walls, CCCC. Whatever kind of support is adopted, the patentee recommends that the girders of the table should rest on a partially elastic bed, E^1E^1, as of caoutchouc, gutta percha, or any of their known preparations, or other suitable elastic substance, so as to obviate the effect of the shock on the trains passing over the platform, and on the lowering of the table on to its solid bearings after having been raised. It will also be obvious that the platform may be sustained on framings of wood placed on the cross walls of the inner pit, extending to the outer wall or curb, and that it will not in general be necessary to excavate the whole pit in which the turn-table is placed. The stop (shown in fig. 5) may be placed at any convenient part of the curb or outer retaining wall of the turn-table pit, or it may be placed near the force or injecting-pump, so that the same person who manages the raising and lowering of the table, may depress the stop when required, by setting his foot upon, or otherwise depressing the foot-plate, G^1, affixed to the top of the spindle, H^1, and thereby overcoming the upward pressure of the helical spring, F, which at all other times either presses the bolt, F^1, into one of the recesses made in the ring, K^1, or causes it to bear up against its lower edge.

The platform (if raised from its bearings) may now be turned round without interruption until the bolt, F^1, comes under the opening, L^1, in the outer rim of the platform, and the bolt falling into this opening, the further turning of the table will be arrested unless the stop is again depressed. The openings, L^1, in the outer rim, K^1, of the platform must be made at intervals corresponding with the distance through which the table, is to be turned for the purpose of bringing the rails, *rr*, in the platform of the table, opposite the line of rails of the permanent way on to which the carriage is to pass from off the table. The foundation of the walls upon which the platform of the table rests, especially of the walls under the central part of the platform, will require particular attention, and in all cases in which the natural foundation is not of the most solid description concrete should be resorted to, so as to ensure a solid foundation for at least the central part, and to guard as much as possible against settlement in any part, after the table has been fixed and adjusted.

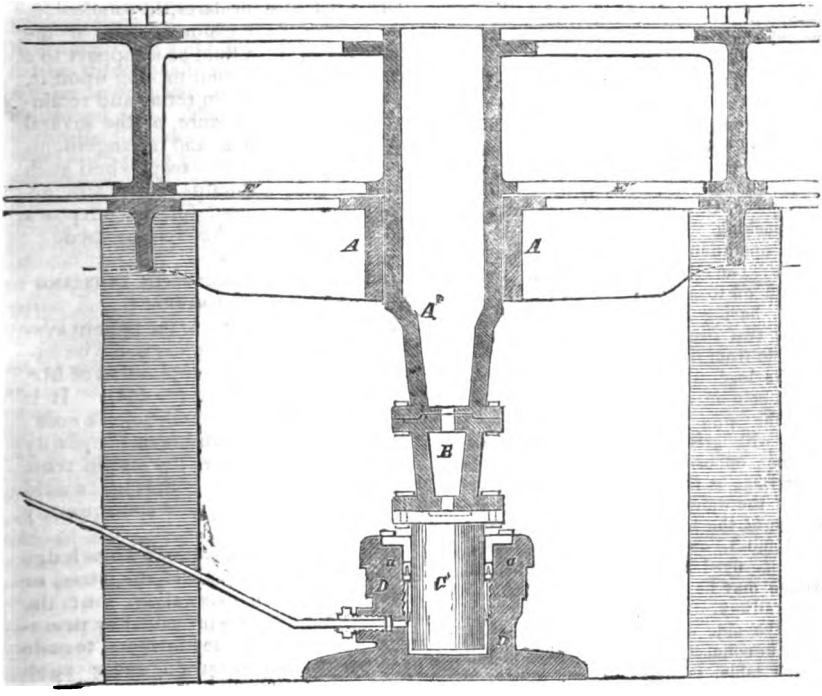
The construction of the force-pump for injecting the water, or fluid, into the raising apparatus requires no explanation; many variets of force or injecting-pumps, both with and without safety-valves, being in use, and their construction being perfectly understood by engineers. The pump shown in fig. 1 is shown as arranged for working two tables, or two sets of tables, but various other arrangements may be adopted. It will be obvious, too, that one pump may be employed in a station for a great number of tables, by simply turning a cock in connection with the pipe leading to the table to be raised. When room is of great importance, as in stations, the forcing or injecting-pump may be placed in the outer, or even the inner pit of the turn-table, or at any convenient place at a distance.

The adaptation of the raising apparatus to the central shaft admits of several arrangements. According to that shown in fig. 1, the central shaft or pillar, B^1, (to which the platform of the table is firmly attached, as already mentioned,) is fitted with great accuracy, so as to turn freely in an upper and a lower collar, A and B, firmly set in the brickwork of the walls, under the rails already referred to, and accurately adjusted

Digitized by Google

to each other, so that the central shaft may be vertical. The raising apparatus is placed immediately below the bottom of the shaft, and consists of a short piston, C, fitted into a cylinder, D, having near the upper part a recess for receiving a cup-packing, *s a*, (as in the hydraulic press,) which may be of leather, as usual, or of the metallo-thionised caoutchouc or gutta percha. The axis, or central line of the piston and cylinder of this raising apparatus, should be placed as nearly as possible in accurate adjustment with the axis or central line of the pillar of the table, and the whole apparatus firmly secured in its place. The necessity which may occasionally exist for introducing fresh packing, renders it necessary to provide suitable arrangements for ready access for that purpose. This may be effected in various ways; for instance, supposing the piston to be at the bottom of the cylinder, and consequently not in contact with the central shaft, the raising apparatus may be withdrawn from under the central shaft and the piston raised out of the cylinder, and fresh packing introduced. Instead of the raising apparatus resting on the foundation, (as shown in fig. 1,) it may be suspended from the lower collar by bolts, D^2 D^2 (of sufficient strength to sustain the weight to be raised by the fluid-pressure), and these being withdrawn, the apparatus may be lowered down (a sufficient depth being left for this purpose) and the piston

Fig. 3.



raised out and fresh packing introduced. Or the raising apparatus may be permanently and solidly fixed, but cut across at the middle of the packing, as shown by the dotted line, E E; the two parts of the cylinder being held together by strong bolts, inserted through flanges cast on the upper and lower portions of the cylinder. In this last case, the piston must be of such a length as that when the piston falls to the bottom of the cylinder, the top of the piston may be on a level with the dotted line; the bolts in the flanches being then unscrewed, the top of the cylinder may be lifted off and fresh packing introduced. If the junction of the upper and lower part of the cylinder in the middle of the packing be objected to, the junction may be made at the top of the recess, (as in fig. 7;) for the leather packing instead of at the middle, as indicated by the lines, E E, and the upper part, L, may be made to fit as an external cylinder, or cap, upon the top of the lower part, D.

Digitized by Google

When instead of having the lower collar, as above described, the raising apparatus is made to answer that purpose by the lower part of the central column or shaft being accurately fitted as a piston or ram to the cylinder, then the cylinder of the raising apparatus must be very firmly secured sideways to the foundations, as it will have to counteract the tendency of the table to tilt when in the act of turning.

In fig. 3, the raising apparatus is secured at the sides by wedges or blocks, which can be removed, and the table being raised to such a height as to take the line, a^1, of division at the lower end of the shaft, clear of the top of the cylinder, the table is to be wedged up, and the piston being allowed to fall to the bottom of the cylinder (the injection-pipe being disconnected) the raising apparatus can be drawn from under the central shaft and fresh packing introduced, as already described.

In fig. 3, the central shaft is made in three pieces, A^3, B, and C, the middle piece being fitted into square apertures, in, and firmly secured by bolts in the flanges to, the upper and lower pieces, so that the middle piece, B, can be removed at pleasure, and the lower piece, C, removed so as to introduce fresh packing.

The operation of turning the table is as follows: The carriage which is to be turned and run on to another line of rails, or reversed, having been run upon the table, one or two strokes of the pump will raise the table from its bearing, E^1E^1; the table with its load will then be sustained by a central column or pillar, resting on a fluid, and (the stop being depressed) may be turned with great facility. The table having come opposite to the rails on to which the carriage is to be run, the extreme pressure of the water will be released by turning one of the handles, N^1N^1, (shown in figs. 1 and 3,) and the table will again sink on to its fixed bearings, E^1E^1, when the carriage may be run off from the table on to the railway.

By the side of the force, or injecting-pump, in connection with the pipe leading to each table, is placed an air-gauge, O, which may be used for several purposes; *firstly*, as soon as the water-level becomes stationary, or the compression of the air ceases, the table will have been raised, and to whatever height the table is raised by the injection of fresh fluid the gauge will remain stationary. Thus the gauge may be employed to facilitate the working of the table. *Secondly*, the gauge may be employed to ascertain the load which is on the table. For this purpose the height at which the water stands when no carriage is on the table, or when the weight of the table only is sustained, will be the zero of the scale, and the weight of the table being known, the degree of compression will indicate the weight of the additional load, the pressure-gauge being graduated according to rules, which are well understood. *Thirdly*, the gauge will serve to indicate whether there is an impediment to the lifting of the table besides the mere weight to be raised, inasmuch as if any obstruction exists, the gauge will not attain a stationary position, but the compression will continue beyond the ordinary limits of loads to be lifted. Hence, if from any cause the table is out of working condition the gauge will show it. If there be leakage in the pumps or raising apparatus, the gauge will not stand at a higher level with each stroke of the pump.

The patentee declares, in conclusion, that he does "not claim as new, or the exclusive use of a fluid as a support to a central shaft or column turning upon it, or the apparatus for injecting and retaining fluid under pressure, or the several parts of the table and arrangements shown in the figures, except when such fluid-pressure apparatus parts and arrangements are used for the purposes and in the manner" before described.

GIBBON'S IMPROVEMENTS IN TRUSSING BEAMS AND GIRDERS.

Sir,—The objections to the present system of trussing cast girders would be increased fourfold by the application of Mr. Gibbon's improvement (p. 454.) It is the great elasticity of malleable as compared with cast iron, causing an inequality of action, which renders the tensile truss comparatively useless. Springs would increase this inequality, and consequently the inutility.

It is either from a want of knowledge of the statical conditions of the truss, or it is an error in delineation, that the springs (fig. 2) are represented as pressing transversely on the horizontal tensile bars. A transverse strain under such circumstances is highly objectionable, especially as it is easily avoided by bringing the pressure on the joists.

It is ridiculous to suppose that the tensile bar (fig. 1) would of itself be able to support that weight which had caused rupture when resisted by the united efforts of both bar and girder.

If the girders did break, it would not be at *c* (fig. 1), unless from some imperfection in the material.

I am, Sir, yours, &c., W.

London, Nov. 8th, 1847.

Digitized by Google

GEOMETRY OF THE LINE AND PLANE.—BY T. S. DAVIES, F.R.S., L. & E., F.S.A., ROYAL MILITARY ACADEMY, WOOLWICH.

(Continued from p. 388.)

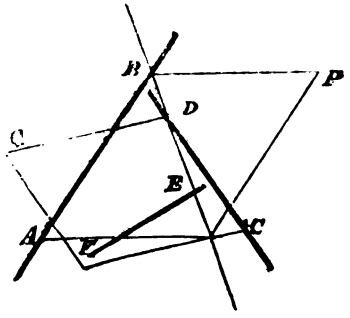
Parallel Lines and Planes.—(Concluded.)

PROP. XXIII.

[This proposition is intended o comprise under one heading several connected properties that are usually kept separate. Those readers to whom the subject is new may pass them over on the first reading; but they are too intimately connected with the foregoing propositions to properly admit of being transposed to another part of this course, and too important to be ommitted altogether.]

(1.) *If any three lines in space be given, no two of which are in the same plane, innumerable straight lines may touch them all three*

Let AB, CD, EF be three lines, no two of which are in the same plane: then through *any point* E in one of them, EF a straight line may be drawn which shall touch AB and CD.



For through AB and E let the plane AP be drawn, and through CD and E the plane CQ. These will intersect in a straight line which passes through E.

Moreover this line is in the plane AP and therefore in the same plane with AB; whence, *generally*, the line through E, in which the planes intersect will touch (that is, meet) AB.

In the same manner it may be proved that the same line will touch CD. Whence one line can be drawn, as stated in the enunciation.

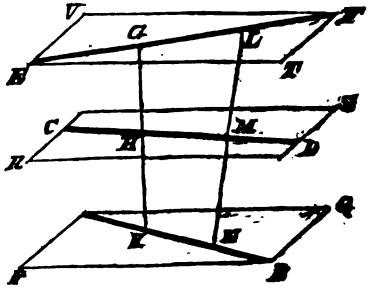
Again, since E is *any point* in EF, the reasoning will equally apply to *every point* in EF without restriction; and hence it follows that innumerable lines can be so drawn.

Scholium.

The case of the line through E being parallel to AB or CD, is included in the idea of an intersection being infinitely remote. Also, had the point E been taken infinitely distant in either direction, the line BDE would have been that of the intersection of two planes through AB and CD, both of which were parallel to EF.

(2.) *If the three straight lines be parallel to the same plane, and no two of them parallel to each other; then all lines resting on them, drawn as in the preceding case, will be divided proportionally.*

Let the lines AB, CD, EF be parallel to one plane (not exhibited in the figure), and let lines KHG, NML rest upon them: then GH : HK :: LM : MN.

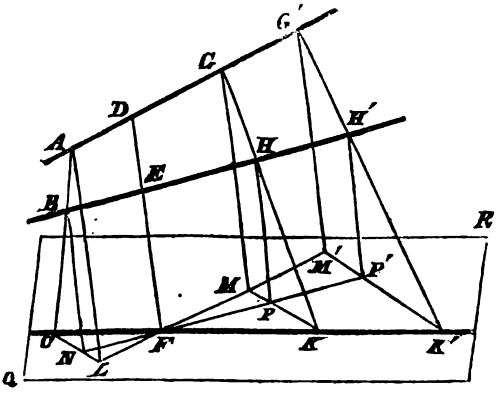


For since AB, CD, EF are parallel to the same plane, planes PQ, RS, TV can be drawn through them parallel to that plane (*props.* 8 and 10.) The lines KHG, NML resting on AB, CD, EF are cut by the planes PQ, RS, TV in the same points as they are cut by the lines; whence GK, LN are cut in G, H, K and L, M, N by parallel planes, and are therefore divided proportionally, (*prop.* 20.) Wherefore,

GH : HK :: LM : MN.

Digitized by Google

(3.) *If three straight lines be parallel to the same plane, and no two of them in one plane, then all straight lines which rest upon them will divide them at the points of contact proportionally.*



Let AG, BH, CK be parallel to the same plane (not exhibited in the figure), and let any number of lines ABC, DEF, GHK, *etc.*, rest upon them; then

AD : DG :: BE : EH :: CF : FK.

For through CK draw the plane QR parallel to that specified in the enunciation; through A, G, B, H draw lines AL, GM, BN, HP parallel to EF, meeting the plane PQ in L, M, N, P; and join LF, MF, NF, PF.

Then, since AL, BN are parallel to DF, they are parallel to one another (*prop.* 6,) and are hence in one plane; and since A, B are points in the parallels AL, BN, the line AC is in that plane.

Whence the points C, N, L being in the two planes ACL and QR, the points C, N, L are in one straight line, viz., the intersection of the two planes.

In the same way it is proved that M, P, K are in one straight line.

Again, since A, D, G are in one line, and the three lines AL, DF, GM are parallel, they are in one plane; and hence the points L, F, M which are in both planes ALMG and QR are in one line, viz., their intersection. That is, L, F, M are in one straight line.

Since AL, GM are parallel, and drawn from points A, G in AG, and since AG is parallel to the plane PQ, the lines AD, LM are equal and parallel. In like manner NP is equal and parallel to BH. Also, since DF is parallel to AL and GM we have AD=LF and DG=FM; and similarly, NF=BE and FP=EH.

Now parallels, and (2) of this we have

CN : NL :: CB : CA :: KH : HG :: KP : PM;

and hence CL is parallel to MK.

Wherefore CF : FK :: NF : FP :: LF : FM :

Or, CF : FK :: BE : EH :: AD : DG.

In the same maaner it may be proved for any number of lines analogous to AC, DF, GK; as, for instance, G'H'K'.

(4.) *If three lines be parallel to a plane, and no two of them in one plane, all the lines which can be drawn to rest upon them will be parallel to one plane.*

(*Preceding Figure.*)

Let AG, BH, CK be three lines all of which are parallel to one plane, (not ex-

Digitized by Google

hibited in the figure) and no two of them in the same plane: then if lines ABC, DEF, GHK rest upon them, all these lines will be parallel to another plane.

For since AC, CL are respectively parallel to AM, MK, (*preceding case*) the plane GMK is parallel to the plane ACL (*prop.* 7); and hence GK situated in the plane MGK can never meet the plane ACL. In other words, GK is parallel to any plane which is drawn parallel to AC and DF.

In the same way the property is proved to hold true for any other line, as G'H'K' which rests upon the three given lines AG, BH, CK.

(5.) *Let any three straight lines, no two of which are in the same plane have three others resting upon them; and let two lines of either series be divided in the same ratio by the other series; then will all three lines of that series be divided in the same ratio, and likewise the three of the other series in the same ratio; and each series will lie in parallel planes.*

These follow as corollaries of the preceding and need no formal demonstration.

The following also is easily deducible from the same kind of reasoning modified to suit the case:

(6.) *Let there be a quadrilateral figure whose sides are not all in one plane; and let each pair of opposite sides be similarly divided: then the lines joining the opposite points of division will be in the same plane; the lines joining the adjacent points of division will meet in the diagonals of the quadrilateral, one pair in one diagonal, the other in the other; the lines themselves will be divided at their point of mutual section in the same ratio as the opposite pair of sides which they do not respectively meet; and the three lines of each series will be in parallel planes.*

[The next Chapter will commence the properties of *Perpendicular Lines and Planes.*]

A PLUS AND MINUS PUZZLE.

Sir,—I am induced to appeal to you by a circumstance of a most perplexing, I may say, alarming character; for if the train of reasoning to which I have been obliged to succumb, were in more general use, the mischief that might ensue to that most useful body of men, the money-lenders, would be incalculable.

About a month ago, I advanced in a weak moment the sum of thirty shillings to an ingenious friend, who, on my making application to him yesterday for the amount, tendered me half-a-sovereign, coolly assuring me that that was all he owed me, and that he was prepared to prove it.

At this announcement I was,—to use an expressive phrase,—"struck all of a heap;" but my friend, producing his pocket-book, went on to say, "Have the kindness to attend. I know you pride yourself on your mathematical acquirements, and I am therefore confident you will listen to reason. Now, we will call a sovereign A, and a half-sovereign B. You assert that you have lent me A + B, and I have now returned you A − B; if I prove to you that these sums are equal, I am sure you will be satisfied." To such a reasonable proposal I, of course, assented.

He continued: "Since

$$A = 2B \quad \therefore \quad AB = 2B^2$$

and $AB + AB = 2B^2 + 2B^2$

$\therefore$ by transposition $AB - 2B^2 = -AB + 2B^2$

Now, by adding $A^2 - 2AB$ to each side of the equation, you will have

$$A^2 - AB - 2B^2 = A^2 - 3AB + 2B^2$$

Divide each side by A − 2B and you will find that

$$A + B = A - B;$$

or that a sovereign and a half is no more than a sovereign minus a half, which is the sum I gave you; so I hope I shall hear no more about the matter."

I rather demurred to all this, but he produced, from what he assured me was a Text-book at Cambridge—*The Facetiæ Cantabrigienses*—(an odd title I thought for a scientific work, but one does see odd titles), the following equation:

Digitized by Google

Let $x=1$
and $y=1$
then $x=y$ and $x^2=xy$ take from each y^2
$x^2-y^2=xy-y^2$ divide each by $x-y$
$x+y=y$
or $1+1=1$

This seemed so similar a case, that I began to reflect with the Vicar of Wakefield, that the number of witnesses was a strong presumption they were right, and that St. Gregory upon Good Works professes himself to be of the same opinion; so, being unable to discover any error in my friend's calculation, and as doubting the correctness of the result might destroy my mathematical reputation, I was fain to depart with my half-sovereign, vowing inwardly never to lend money again.

Could you, Sir, or any of your correspondents point out the fallacy that has thus lightened my pocket? I cannot help thinking it consists in constructing an equation, both sides of which =0; but which, on being divided by another good-for-nothing expression, produces different quotients: and at the same time I must express my opinion, that it is disgraceful on the part of algebra to suffer such a thing to be possible.

I am, Sir, yours &c.,
J. E.

BOURNE'S CATECHISM OF THE STEAM-ENGINE.*

"The present work," says the author, "is not intended as a substitute for the quarto treatise on the Steam-engine which I lately published, but is rather to be regarded as an introduction, and in some measure also as a supplement to that work. The mode of publication of the quarto treatise rendered faults of arrangement inevitable that need not exist in the present undertaking, and it appears to me that a work upon the steam-engine, which in a moderate compass should give an outline of the whole subject on its practical aspect would still be of much utility."

The "quarto treatise" to which Mr. Bourne alludes, is the treatise "by the Artizan Club," of the earlier numbers of which we have a recollection of having had occasion to speak in terms of some severity. The appearance of the present sequel has brought to mind also an unfulfilled promise to pay our respects to the entire work, when completed. The reason of our not doing so it may now be as well to state. With the last of the work there came out a preface, (which like all *pre*-faces was a veritable *post*-script) in which the author acknowledged so frankly and ingenuously the principal deficiencies of his performance, as entirely to disarm criticism. It left no more to be said. We think Mr. Bourne has now acted somewhat unwisely in recalling attention so pointedly to that ponderous jumble. It would be a great pity were the present "Catechism" a thing which could only be used as an "introduction," or a "supplement" to the "Treatise." The octavo is in every way so vastly superior to the quarto as to make companionship out of the question. The dozen men rolled into one (of whom Mr. Bourne erewhile affected to be the impersonation, on the modest theory, we suppose, that a person equal to the production of such a prodigy of genius as the "Treatise," must himself be a twelve-headed prodigy at least,) are nothing to the one man in his own proper person. Neither, we are glad to say, is there any necessary connection between the two works. All that is requisite to enable any one to avail himself to the fullest extent of the information in the "Catechism," is a knowledge of the mechanical construction of the steam-engine; and that is to be obtained quite as well from other works as the "Treatise"—from most of them much better. We do not like the question and answer, or Prigg and Harris' style, which Mr. Bourne has adopted in this instance, any more than we liked his "Club" fiction, and could

* A Catechism of the Steam Engine. By John Bourne, C.E., 8vo., p. 276. Williams and Co., 1847.

Digitized by Google

wish he were cured of all such affectations; we deem it, too, a considerable defect in the "Catechism," that it is entirely destitute of graphic illustration—containing not a single plate, or woodcut; but passing these objections over—which are objections touching the manner, more than the matter of the book—we are happy to be able to bestow upon it nearly unqualified praise. It is a cheap book, yet of priceless value to all engine-makers and engine-users; containing a large amount of practical information on the subject of the steam-engine, such as is to be met with nowhere else, not even in a detached and scattered shape. The information, too, is given with great fulness, clearness, and distinctness. The author does not always carry you along with him in his conclusions, and is dogmatical at times; but he seldom, if ever, gives you any reason to doubt his wish to be just and impartial. Everything, moreover, is to the point; no idle digressions, no empty declamation—none of that mawkish sentimentalism which was so disgusting in the "Treatise," and is so disgusting everywhere.

We have only room at present for a single specimen; and though we might readily extract a better, we prefer this one, on account of the evidence which it furnishes, that the philosophical genius which presided over the establishment of the Soho Works, has not expired with their illustrious founder:

Effect of the Lines of Steam-vessels on their Speed.

"*Q.*—But may not the different shapes be so classified that the speed answerable to a given power in a specified class can be approximately predicted?

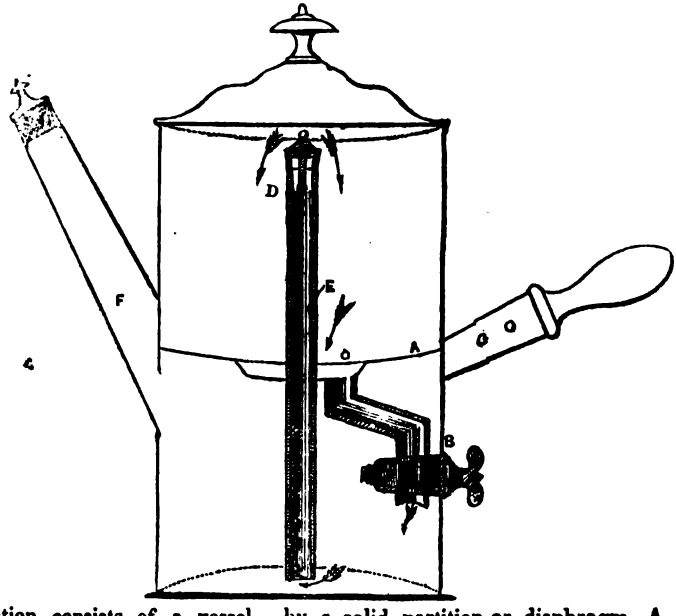
"*A.*—Yes, that may be done, and *has* been done, by Boulton and Watt, who have ascertained, experimentally, the speed realized by different forms of vessels with different powers of engine, and have deduced from thence rules which enable them to tell with great precision the speed which any new vessel, of a particular form and power, will achieve. The first set of experiments was made in 1828, upon the vessels *Caledonia*, *Diana*, *Eclipse*, *Kingshead*, *Moordyke*, and *Eagle*; vessels of a similar form and all with square bilges and flat floors; and the result was to establish the number 925 as the co-efficient of performance of such vessels. This co-efficient is obtained by multiplying the cube of the velocity of the vessel in miles per hour by the sectional area of immersed midship-section in square feet, and dividing by the nominal horse power; and its use is to enable us to determine the speed of any similar vessel with any other area of midship section, and any other number of nominal horse power. The better the shape of the vessel is, the larger the co-efficient becomes, as appears by the second set of experiments, which were made upon the superior vessels *Venus*, *Swiftsure*, *Dasher*, *Arrow*, *Spitfire*, *Fury*, *Albion*, *Queen*, *Dart*, *Hawk*, *Margaret*, and *Hero*—all vessels having flat floors and round bilges, where the co-efficient became 1,160. The third set of experiments was made upon the vessels *Lightning*, *Meteor*, *James Watt*, *Cinderella*, *Navy Meteor*, *Crocodile*, *Water-sprite*, *Thetis*, *Dolphin*, *Wizard*, *Escape*, and *Dragon*—all vessels with rising floors and round bilges, and the co-efficient of performance was found to be 1,430. The fourth set of experiments was made in 1834, upon the vessels *Magnet*, *Dart*, *Eclipse*, *Flamer*, *Firefly*, *Ferret*, and *Monarch*, when the co-efficient of performance was found to be 1,580. The velocity of any of these vessels, with any power or sectional area, may be ascertained by multiplying the co-efficient of its class by the nominal horse power, dividing by the sectional area in square feet, and extracting the cube root of the quotient, which will be the velocity in miles per hour; or the number of nominal horse power requisite for the accomplishment of any required speed may be ascertained by multiplying the cube of the required velocity in miles per hour, by the sectional area in square feet, and dividing by the co-efficient; the quotient is the number of nominal horse power requisite to realize the speed. In the whole of these experiments the pressure of steam in the boiler varied between 2¾lbs. and 4lbs. per square inch, and the effective pressure on the piston varied between 11lbs. and 13lbs. per square inch, so that the average ratio of the nominal to the actual power may be easily computed; but it will be preferable to state the nominal power of some of the vessels, and their actual power as ascertained by experiment. Of the *Eclipse*, the nominal power was 76, and the actual power 144.4 horses; of the *Arrow*, the nominal power was 60, and the actual 119.5; *Spitfire*, nominal 40, actual 64; *Fury*, nominal 40, actual 65.6; *Albion*, nominal 80, actual 135.4; *Dart*, nominal 100, actual 152.4; *Hawk*, nominal 40, actual 73; *Hero*, nominal 100, actual 171.4; *Meteor*, nominal 100, actual 160; *James Watt*, nominal 120, ac-

Digitized by Google

tual 204; *Watersprite*, nominal 76, actual 157.6; *Dolphin*, nominal 140, actual 238; *Dragon*, nominal 80, actual 131; *Magnet*, nominal 140, actual 238; *Dart*, nominal 120, actual 237; *Flamer*, nominal 120, actual 234; *Firefly*, nominal 52, actual 86.6; *Ferret*, nominal 52, actual 88; *Monarch*, nominal 200, actual 378. In the case of swift vessels of modern construction, such as the *Red Rover*, *Herne*, *Queen*, and *Prince of Wales*, the co-efficient appears to be about 2,550; but in these vessels there is a still greater excess of the actual over the nominal power than in the case of the vessels previously enumerated, and the increase in the co-efficient is consequent upon the increased pressure of the steam in the boiler, as well as the superior form of the ship. The nominal power of the *Red Rover*, *Herne*, and *City of Canterbury* is, in each case, 60 horses, but the actual power of the *Red Rover* is 147, of the *Herne* 177, and of the *City of Canterbury* 153, and in some vessels the excess is still greater; so that with such variations it becomes necessary to adopt a co-efficient derived from the introduction of the actual instead of the nominal power. In the first class of vessels experimented upon, the actual power was about 1.6 times greater than the nominal power; in the second class, 1.67 times greater; in the third class, 1.7 times greater; and in the fourth, 1.96 times greater; while in such vessels as the *Red Rover* and *City of Canterbury* it is 2.65 times greater, so that if we adopt the actual instead of the nominal power in fixing the co-efficients, we shall have 554 as the first co-efficient, 694 as the second, 832 for the third, and 806 for the fourth, instead of 925, 1,160, 1,430, and 1,580 as previously specified; while for such vessels as the *Red Rover*, *Herne*, *Queen*, and *Prince of Wales*, we shall have 962 instead of 2,550. These smaller co-efficients then express the relative merits of the different vessels without reference to any difference of efficacy in the engines, and it appears preferable, with such a variable excess of the actual over the nominal power, to employ them instead of those first referred to. From the circumstance of the third of the new co-efficients being greater than the fourth, it appears that the superior result in the fourth set of experiments arose altogether from a greater excess of the actual over the nominal power."

WALLER'S PATENT COFFEE-POT.

[Patent dated February 16, 1847. Specification enrolled August 16, 1847.]



This invention consists of a vessel divided horizontally into two equal parts by a solid partition or diaphragm, A, which partition is stamped like a dinner-

Digitized by Google

plate with a broad rim, the central depressed portion being pierced by a hole, around the edge of which is attached a bent tube, connected to a tap, B; by which arrangement a passage or way may be opened or shut off, at pleasure, from the upper to the lower half of the vessel. Around the margin of the dished part of the diaphragm is soldered a strainer, C, of very finely perforated metal. E is a vertical pipe, reaching from within a short space of the bottom of the lower chamber to nearly the top of the upper one, passing through the diaphragm and perforated plate, to both of which it is firmly soldered. In the top of this tube there is a valve, D. F, is an ordinary spout with a cork plug, or stopcock, which fits it so tightly as to render it when necessary air-tight. G, is a common handle.

The mode of using the pot is as follows:—The tap at the side being closed, and the cork or stopper removed from the spout, you pour the requisite quantity of water, hot or cold, into the upper half of the vessel; you then turn the tap downwards, when the water will run into the lower half, upon which, put in the ground coffee on the strainer, C, taking care that none of it lodges on the top valve, D; you next replace the cork or stopper, turn the tap again horizontally, and place the pot on the fire. The water is, by the pressure of the steam, soon forced up the central tube, and falls at the required temperature *upon the coffee*. After a few seconds, take the vessel off, and away from the fire, and allow it to stand about three minutes. You then turn the tap downwards, when the infusion will, by the pressure of the atmosphere upon the vacuum in the lower chamber, rapidly filter into it, and be at once ready for use, in a beautifully bright and boiling condition, leaving the grounds in a dry and hardened state.

It will be readily seen that the valve prevents the air from re-entering the lower chamber, after its total expulsion thence by the creation and subsequent condensation of steam. An almost perfect vacuum is thus preserved for any required period, and rendered available for effecting rapid filtration whenever it may be desired, by simply turning the tap, and thereby opening the way between the filtering-grate and the vacuum chamber below.

The advantages that may be fairly claimed for his apparatus are these: In the first place, it consists but of one thing, having not a single detached portion, save the cork or stopper; it requires no taking to pieces, no screwing or unscrewing of parts, no putting in and taking out of filtering-grates, or flannel-bags, or other troublesome appliances; neither does it involve any complicated machinery, neither wheels, nor pistons, nor pumps, nor anything of the sort. Again; no exertion is required in using it, and with common care it cannot get out of order. By simply rinsing it out occasionally, it will always be clean and fit for use. Moreover, the whole process of making the coffee being conducted in a closed vessel, not a particle of its aromatic flavour can be dissipated. The infusion is of an exceedingly rich, fresh, and fragrant quality, very different from the thick, rancid, and heating liquid produced by the pernicious practice of boiling or long infusing. The water in this apparatus does not come in contact with the coffee till it has acquired the proper temperature; consequently the infusion must be hot. And, finally, the steam which escapes gives notice by its action on the valve of the necessity for removing the vessel from the fire (making its exit *over* the infusion, and *not through* it), and thus serves as a medium of protection and entirely prevents any loss from evaporation. Should any coffee be left unexhausted, it may be easily preserved from the air and heated again in the same vessel.

As in this apparatus the vacuum admits of being preserved for any length of time, it may obviously be applied with great advantage by chemists, druggists, and medical men, for preparing and filtering their infusions, tinctures, mixtures, &c.,—a process now exceedingly tedious and troublesome, especially when it is desired to filter very fine liquids.

FIELD'S EBULLITION ALCOHOLMETER. BY ANDREW URE, M.D., F.R.S., ETC.

[From the *Pharmaceutical Journal* for October, 1847.]

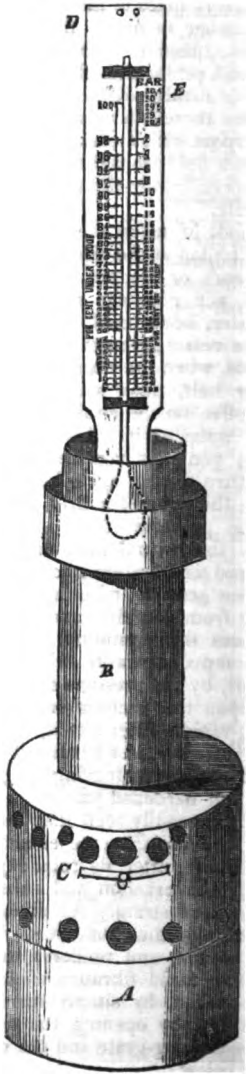
That the boiling temperature of water is increased by holding neutro-saline and saccharine substances in solution has been long known, and has been the subject of many experiments, made partly with the view of ascertaining from that temperature the pro-

Digitized by Google

portion of the salt or sugar, and partly with the view of obtaining a practical liquid bath. But it seems to have been reserved for the Abbé Brossard-Vidal, of Toulon, to have discovered that the boiling temperature of alcoholic liquors is, in most cases, proportional to the quantity of alcohol, irrespectively of the quantity of neutro-saline or saccharine matter dissolved in them. When, however, such a quantity of dry carbonate of potash, or sugar, is added to a spirituous liquor as to abstract or fix in the solid state a portion of the water present, then the boiling temperature of that mixture will be lowered in proportion to the concentration of the alcohol, instead of being raised, as would be the case with water so mixed. But, generally speaking, it may be assumed as a fact, that the boiling point of an alcoholic liquor is not altered by a moderate addition of saline, saccharine, or extractive matter. On this principle, M. Brossard-Vidal constructed an instrument for determining by that temperature the proportion of alcohol present. His chief object was to furnish the Revenue Boards of France with a means of estimating directly the proportion of alcohol in wines, so as to detect the too common practice of introducing brandy into their cities and towns under the mask of wine, and thereby committing a fraud upon the *octroi*; as the duty on spirits is much higher than on wines.

The instrument consists of a spirit-lamp, surmounted by a small boiler, into which a large cylindric glass bulb is plunged, having an upright stem of such calibre, that the quicksilver contained in them, may, by its expansion and ascent when heated, raise before it a little glass float in the stem, which is connected by a thread with a similar glass bead, that hangs in the air. The thread passes round a pulley, which turning with the motion of the beads, causes the index to move along the graduated circular scale. The numbers on this scale represent per centages of absolute alcohol, so that the number opposite to which the index stops, when the liquor in the cylinder over the lamp boils briskly, denotes the per centage of alcohol in it.

Such was the instrument when it was placed in my hands some months ago by Mr. Field, who had obtained a patent in this country for determining thereby the strength of spirituous liquors. I made a great many experiments on the boiling points of alcohol at various successive degrees of watery dilution, and verified the general utility of the contrivance, but I found the construction of the instrument subject to several defects. The mass of mercury to be heated in the large bulb was so great as to occasion some loss of alcohol in the course of the experiment; the length of the thread was liable to be affected by the moisture of the air, it occasionally failed to move the pulley with sufficient delicacy on account of friction, and when the spirit in the lamp got heated in its case, it flared up and burned the thread, thus rendering the apparatus useless till a fresh thread was experimentally adjusted to the beads.



Digitized by Google

On these accounts I renounced the construction of M. Vidal, and adopted the more simple and direct form of indication represented in the figure:

First, of a spirit-lamp, A, surrounded by a saucer for containing cold water to keep the lamp cool, should many experiments require to be made in succession; and, *second*, of the boiler, B, which fits by its bottom cage, C', on the case of the lamp. At the point C, is seen the edge of the damper-plate for modifying the flame of the lamp, or extinguishing it when the experiment is completed. D, is the thermometer made with a very minute bore, in the manner of the Rev. Mr. Wollaston's instrument for measuring the height of a mountain by the boiling point of water on its summit. The bottom of the scale in the ebullition thermometer is marked P, for proof, on the left side, and 100 (proof spirit) on the right side. It corresponds to 178.6 Fahr. nearly, or the boiling point of alcohol of 0.920, specific gravity. The following table gives the boiling points corresponding to the specific gravities.

Temp. Fahr.	Specific Gravity.		Temp. Fahr.	Specific Gravity.	
178.5	0.9200	P.	185.6	0.9665	50 U.P.
179.75	0.7321	10 U. P.	189.0	0.9729	60 ,,
180.4	0.9420	20 ,,	191.80	0.9786	70 ,,
182.01	0.9516	30 ,,	196.4	0.9850	80 ,,
183.40	0.960	40 ,,	202.0	0.992	90 ,,

The above table is the mean of a great many experiments. When alcohol is stronger than 0.92, or the excise-proof, its boiling point varies too little with its progressive increase of strength, to render that test applicable in practice. In fact, even for proof spirits, or spirits approaching in strength to proof, a mere exact indication may be obtained by diluting them with their own bulk of water, before ascertaining their strength, and then doubling it.

The boiling point of any alcoholic liquor is apt to rise if the heat be long continued, and thereby to lead into error in using this instrument. This source of fallacy may be in a great measure avoided by adding to the liquor in the little boiler about a teaspoonful (35 grains) of common culinary salt, which has the curious effect of arresting the mercury in the thermometer at the true boiling point of the spirit, wine, or beer, to enable a correct reading to be had.

The thermometer is at first adjusted to an atmospheric pressure of 29.5 inches. When the pressure is higher or lower, both water and alcohol boil at a somewhat higher or lower temperature. In order to correct the error which would hence arise in the indication of this instrument under different states of the weather, a barometrical equation is attached by means of a subsidiary scale, E, to the thermometer, D.

Having stated the principles and the construction of the ebullition alcoholmeter, I shall now describe the mode of its application.

First, Light the spirit-lamp, A.

Second, Charge the boiling vessel, B, with the liquid to be tested (to within an inch of the top), introducing at the same time a paper of the powder; then place the vessel, B, (the damper-plate being withdrawn) on the lamp, A.

Third, Fix the thermometer, D, on the stem attached to B, with its bulb immersed in the liquid. The process will then be in operation.

The barometrical scale indicated on the thermometer, is opposite the mean boiling point of water. Prior to commencing operations for the day, charge the boiler, B, with water only, and fix the instrument as directed; when the water boils freely the mercury will become stationary in the stem of the thermometer, opposite to the true barometrical indication at the time. Should the mercury stand at the line 29.5, this will be the height of the barometer, and no correction will be required; but should it stand at any other line, above or below, then the various boiling points will bear reference to that boiling point.

In testing spirituous, or fermented liquors of any kind, when the mercury begins to rise out of the bulb of the thermometer into the stem, push the damper-plate halfway in its groove to moderate the heat of the flame. When the liquor boils freely, the mercury will become stationary in the stem; and opposite to its indication, on the left, the under-proof per centage of spirit may be read off at once, if the barometer stands that day at 29.5 inches; while on the right-hand scale, the per centage of proof spirit is shown; being the difference of the former number from 100. The damper-plate is to be immediately pushed home to extinguish the flame.

The alcoholmeter will by itself only indicate the per centage or alcohol contained in any wine; but by the aid of the hydrometer, the proportionate quantity of saccharum in all wines may be readily and easily determined. The hydrometer will show the specific gravity of the liquid upon reference

Digitized by Google

to table (No. 1,) annexed. In testing a sample of wine, first take the specific gravity, and suppose it to be 989, then charge the boiler of the alcoholmeter with the wine, as directed, and at the boiling-point it indicates the presence of alcohol at 69.6 per cent.^{up}, whose specific gravity will be found to be 979; deduct that gravity from the gravity of the bulk, or 989, and 10 will remain, which 10 degrees of gravity, upon reference to the wine table, will be found to represent 25 lbs. of saccharine or extractive matter in every 100 gallons, combined with 30$\frac{4}{10}$th the gallons of proof spirit.

Sikes's hydrometer will only show the specific gravity of liquids lighter than water (or 1000) and for wines in general use, their gravities being lighter than that article, will answer every purpose; but there are wines whose gravities are heavier than water, such as mountain, tent, rich Malagas, lachrymæ Christi, &c., to enbrace which additional weights to the hydrometer will be required, as for cordialised spirits, &c. In testing a sample of rich mountain, its S.G. was found to be 1039, or 39 degrees heavier than water, that wine at the boiling point indicated the alcohol at 72.5 per cent.^{up}; but 980 S.G. deducted from 1039, leaves 59 degrees of S.G.; against 59 of the wine tables will be found 147-5 or 147½ lbs. of saccharine or extractive matter combined with 27½ gallons of proof spirit to every 100 gallons.

Should the barometer for the day show any other indication above or below the standard of 29.5, the thermometer scale will then only show the apparent strength, and reference must be had to the small ivory indicator, E, it being the counterpart of the barometrical scale of the thermometer, thus —should the barometer indicate 30, place 30 of the indicator against the boiling point of the liquid, and opposite the line of 29.5 will be found the true strength.

Example 1.—Barometer at 30.—Suppose the mercury to stop at the boiling-point 72.^{up}, place 30 of the indicator against 72 on the thermometer, and the line of 29.5 will cut 69.6^{up}, the true strength.

Example 2.—Barometer at 29.—Suppose the mercury to stop at the same point, 72.^{up}, place 29 of the indicator against 72 on the thermometer, and the line of 29.5 will cut 74.3^{up}, the true strength.

For Malted Liquors.

To all brewers and dealers in fermented liquors, this principle, by its application, will supply a great desideratum, as it will not only show the alcohol created in the wort by the attenuation, as well as the original weight of the wort prior to fermentation, but it will indicate the value of malt liquors in relation to their componeat parts. It will likewise be a ready means of testing the relative value of worts from sugar compared with grain, as well as being a guide to the condition of stock beers and ales.

To ascertain the strength of malt liquors and their respective values, the instrument has been supplied with a glass saccharometer, testing-glass, and slide-rule. Commence by charging the testing-glass with the liquid, then insert the saccharometer, to ascertain its present gravity or density per barrel, and at whatever number it floats that will indicate the number of pounds per barrel heavier than water.

Example 1.—Suppose the saccharometer to float at the figure 8, that would indicate 8 lbs. per barrel; then submit the liquid to the boiling test, with the salt as before directed, and suppose it should show (the barometrical differences being accounted for) 90-^{up}, that would be equivalent to 10 per cent. of proof alcohol. Refer to the slide-rule, and place A on the slide against 10 on the upper line of figures, and facing B on the lower line will be 18, thus showing that 18 lbs. per barrel have been decomposed to constitute that per centage of spirit; then, by adding the 18 lbs. to the present 8 lbs. per barrel, the result will be 26 lbs., the original weight of the wort after leaving the copper.

Example 2.—The saccharometer marks 10 lbs. per barrel, and at the boiling-point it indicates 88-^{up}, equivalent to 12 gallons of proof spirit per cent.; place A against 12, and opposite B will be 21½ lbs. per barrel, when, by adding that to the 10 lbs. present, 31½ lbs. will be the result.

To Ascertain the Relative Value.

Suppose the price of the 26 lbs. beer to be 36s. per barrel, and the 31 lbs. beer to be 40s. per barrel, to ascertain which beer will be the cheapest, place 26 on the opposite side of the rule against 36, and opposite 31½ lbs. will be 43s. 7d.; showing that the latter beer is the cheapest by 3s. 7d. per barrel.

By taking an account of the malt liquors by this instrument prior to stocking, it may be ascertained at any time whether any alteration has taken place in their condition, either by an increase of spirit by after fermentation and consequent loss of saccharum, or whether, by an apparent loss of both, acetous fermentation has not been going on towards the ultimate loss of the whole.

This instrument will likewise truly indi-

Digitized by Google

cate the quantity of spirit per cent. created in distillers' worts, whether in process of fermentation or ready for the still, the only difference will be in the allowances on the slide-rule.

N.B.—The saccharometers applicable to the foregoing rules for beers, ales, &c., have been adjusted at the temperature 60 Fahr., and will be found correct for general purposes; but where extreme minuteness is required, the variation of temperature must be taken into account, therefore for every 10 degrees of temperature above 60, three-tenths of a pound must be added to the gross amount found by the slide-rule; on the contrary, for every 10 degrees below 60, three-tenths of a pound must be deducted.

For Cordialized Spirits.

The operation in this instance is somewhat different from that of beers, which have the alcohol created in the original worts; whereas, in cordialized spirits, gins, &c., the alcohol is the original, and the saccharine matter, or sugar, is an addendum.

If 100 gallons of spirits are required at a given strength, (say 50 per cent. under proof,) 50 gallons of proof spirit, with the addition of 50 gallons of water, would effect that object, and upon testing it by the alcoholmeter, it would be found as correct as by the hydrometer. But in cordializing spirits it is different, for to the 50 gallons of proof spirit 50 gallons of sugar and water would be added, thereby rendering the hydrometer useless, except for taking the specific gravity of the bulk, and, according to the quantity of sugar present, so a relative quantity of water must have been displaced; and as the sugar has no reducing properties, the alcoholmeter will only show the strength of the cordial in relation to the water contained in it, as the principle indicates, irrespectively of saccharine or extractive matter present.

Suppose, in making 100 gallons of cordial at 50 ^{up}, 3 lbs. of sugar are put to the gallon, or 300 lbs. to the 100 gallons, that 300 lbs. displacing $18\frac{67}{100}$th gallons of water, only $31\frac{33}{100}$th gallons of water instead of 50 have been applied; the sugar, without reducing properties, making up the bulk of 100 gallons, which is meant to represent 50 per cent. ^{up}.

The alcoholmeter will only show at the full point of ebullition the alcoholic strength in relation to the water in the 100 gallons of the mixture, or 35 per cent. ^{up}, leaving 15 per cent. to be accounted for on the bulk.

As the quantity of sugar present must be determined before that per centage can be arrived at, a double object will be effected by so doing, namely, eliciting in all instances the quantity of sugar present, as well as the per centage of spirit to be accounted for.

Example 1.—In taking the S.G. of a cordial, suppose it to be fouud 1076, then submit the liquid to the boiling point, and having ascertained the per centage of alcohol, and it proves to be 35-^{up}, the S.G. of alcohol at that strength will be found to be 956; deduct 956 from the S.G. of the bulk, or 1076, and 120 will remain; refer that to its amount on the head line of table, No. 2, namely 120, under which will be found 3, representing 3 lbs. of sugar to the gallon; and by running the eye down its column to opposite the alcoholic strength indicated (35-^{up}) will be found 14.9, which represents the per centage of water displaced by the sugar, and which amount of 14.9, added to the 35 per cent. ascertained, makes the total upon the bulk 49.9 per cent. ^{up}, with 3 lbs. of sugar to the gallon.

For Gins, &c.

Example 3.—In taking the S.G., suppose it to be found 957; then submit to the boiling point, and it proves to be 14-^{up}, whose S.G. is 937, which deducted from 957, leaves S.G. 20; on the head line of table, No. 2, under 20, will be found $\frac{1}{4}$, or $\frac{1}{4}$ lb. of sugar to the gallon, and on running the eye down to opposite 14-^{up}, will be found 3.0, which added to the 14, makes the total on the bulk 17 per cent. ^{up}, with 50 lbs. of sugar to the 100 gallons.

To chemists for their tinctures, &c., this instrument will be found essentially useful.

N.B.—Care must be taken that the mercury is entirely in the bulb of the thermometer before it is fixed on the stem for operation, and in all cases (except for water) the salt must be used.

Conclusion.

Wines are peculiarly subject to be mystified by adulterations of various kinds. It will prove of great advantage to the public when the relative quantity of fruit, or *saccharum*, and alcohol requisite to constitute the normal wine of each species is well ascertained.

Some beers possess a remarkable narcotic power by which they cause drowsiness and stupor without corresponding previous exhilaration. Such beverages may be justly suspected of having been sophisticated with *cocculus indicus*, opium, or some analogous drug; and this suspicion may become certainty, if they be shown by the alcoholmeter to contain only a few per cents. of fermented spirit.

Digitized by Google

No. 1.

TABLE OF SPECIFIC GRAVITIES by SIKES's Hydrometer, adapted to FIELD's Patent Alcoholmeter for Cordialized Spirits.

TEMPERATURE 60° SPECIFIC GRAVITY OF WATER 1,000°.

60		70		80		90		100		110		120		130		140		150		160		170		180	
Wt.	S.G.	Wt.	S.G.	Wt.	S.G.	Wt.	S.G.	Wt.	S.G.	Wt.	S.G.	Wt.	S.G.	Wt.	S.G.	Wt.	S.G.	Wt.	S.G.	Wt.	S.G.	Wt.	S.G.	Wt.	S.G.
60	922	70	942	80	961	90	981	100	1000	110	1020	120	1041	130	1063	140	1085	150	1107	160	1129	170	1152	180	1175
1	924	1	943	1	963	1	983	1	1002	1	1022	1	1044	1	1065	1	1087	1	1109	1	1131	1	1155	1	1178
2	926	2	945	2	965	2	985	2	1004	2	1024	2	1046	2	1067	2	1089	2	1111	2	1134	2	1157	2	1180
3	928	3	947	3	967	3	987	3	1006	3	1026	3	1048	3	1069	3	1091	3	1113	3	1136	3	1159	3	1182
4	930	4	949	4	969	4	989	4	1008	4	1029	4	1050	4	1071	4	1093	4	1116	4	1139	4	1162	4	1185
5	932	5	951	5	971	5	991	5	1010	5	1031	5	1052	5	1074	5	1096	5	1118	5	1141	5	1164	5	1187
6	934	6	953	6	973	6	993	6	1012	6	1033	6	1054	6	1076	6	1098	6	1120	6	1143	6	1166	6	1189
7	936	7	955	7	975	7	995	7	1014	7	1035	7	1056	7	1078	7	1100	7	1123	7	1145	7	1168	7	1191
8	938	8	957	8	977	8	997	8	1016	8	1037	8	1058	8	1080	8	1102	8	1125	8	1148	8	1171	8	1194
9	940	9	959	9	979	9	999	9	1018	9	1039	9	1061	9	1082	9	1104	9	1127	9	1150	9	1173	9	1196
10	942	10	961	10	981	10	1000	10	1020	10	1041	10	1063	10	1085	10	1107	10	1129	10	1152	10	1175	10	1199

The foregoing Table, which shows the Specific Gravity on the bulk of the mixture, bear reference to the Table (No. 2) of the Alcoholmeter following.

Digitized by Google

No. 2.

TABLE, showing the lbs. of Sugar per Gallon in Cordialized Spirits, with per Centages to be added to the indicated Strength, per the Alcoholmeter.

Difference of Gravity. lbs. of Sugar per Gallon.	10 4 oz. or 25 to 100	15 6 oz. 37½ to 100	20 8 oz. 50 to 100	25 10 oz. 62½ to 100	30 12 oz. 75 to 100	35 14 oz. 87½ to 100	40 1.0	45 oz. 1. 2	50 oz. 1.4	Difference of Gravity. lbs. of Sugar per Gallon.	
Sp. Grav of Spirit.	Per Cent of Spirit.									Per Cent of Spirit.	Sp. Grav of Spirit.
920	Pf.	1.6	2.5	3.4	4.4	5.3	6.2	7.1	8.1	9.0	Pf.	920
923	2.5	1.6	2.5	3.3	4.3	5.2	6.1	6.9	7.8	8.8	2.5	923
926	5.	1.5	2.4	3.2	4.2	5.0	5.9	6.8	7.7	8.6	5.	926
929	7.5	1.5	2.3	3.2	4.1	4.9	5 8	6.6	7.5	8.4	7.5	929
932	10.	1.4	2.2	3.1	4.0	4.8	5.7	6.5	7.4	8.2	10.	932
935	12.5	1.4	2.2	3.1	3.9	4.7	5.5	6.3	7.2	8.0	12.5	935
938	15.	1.4	2.1	3.0	3.8	4.6	5.4	6.2	7.0	7.8	15.	938
940	17.5	1.3	2.1	2.9	3.7	4.5	5.3	6.0	6.8	7.6	17.5	940
943	20.	1.3	2.0	2.8	3.6	4.4	5.2	5.9	6.7	7.5	20.	943
945	22:5	1.3	2.0	2.7	3.5	4.3	5.0	5.7	6.5	7.3	22.5	945
948	25.	1.2	1.9	2.6	3.4	4.1	4.8	5.5	6.3	7.0	25.	948
950	27.5	1.2	1.9	2.5	3.3	4.0	4.7	5.3	6.1	6.8	27.5	950
952	30.	1.1	1.8	2.4	3.1	3.8	4.5	5.1	5.8	6.5	30.	952
954	32.5	1.1	1.7	2.3	3.0	3.6	4.3	4.8	5.5	6.2	32.5	954
956	35.	1.0	1.6	2.2	2.9	3.5	4.1	4.6	5.3	6.0	35.	956
958	37.5	1.0	1.6	2.1	2.8	3.4	3.9	4.4	5.1	5.8	37 5	958
960	40.	.9	1.5	2.0	2.7	3.2	3.8	4.3	4.9	5.5	40	960
962	42.5	.9	1.5	2.0	2.6	3.1	3.6	4.1	4.7	5.3	42.5	962
964	45.	.9	1.4	1.9	2.5	3.0	3.5	4.0	4.6	5.1	45.	664
965	47.5	.8	1.4	1.9	2.4	2.9	3.4	3.9	4.4	4.9	47.5	965
967	50.	.8	1.3	1.8	2.3	2.8	3.3	3.8	4.3	4.8	50.	967
969	52.5	.7	1.2	1.7	2.2	2.6	3.1	3.6	4.1	4.5	52.5	969
970	55.	.7	1.2	1.6	2.0	2.4	2.9	3.4	3.8	4.2	55.	970
972	57.5	.6	1.1	1.5	1.9	2.2	2.7	3:1	3.5	3.9	57.5	972
973	60.	.6	1.0	1.4	1.8	2.1	2.5	2.9	3.3	3.6	60.	973
974	62.5	.6	1.0	1.3	1.7	2.0	2.4	2.7	3.1	3.4	62.5	974
976	65.	.5	.9	1.2	1.5	1.8	2.2	2.5	2.8	3.1	65.	976
977	67.5	.5	.8	1.1	1.4	1.7	2.0	2.3	2.6	2.9	67.5	977
979	70.	.4	.7	1.0	1.3	1,5	1.8	2.1	2.4	2.6	70.	979
980	72.5	.4	.7	.9	1.1	1.3	1.6	1.9	2.1	2.3	72.5	990
982	75.	.3	.6	.8	1.0	1.2	1.4	1.6	1.8	2.0	75.	982
983	77.5	.3	.5	.7	.9	1.0	1.2	1.4	1.6	1.8	77.5	983
984	80.	.2	.4	.6	.8	.9	1.0	1.2	1.4	1.6	80.	984
986	82.5	.2	.3	.5	.7	.8	.9	1.0	1,2	1.4	82.5	986
988	85.	.2	.2	.4	.6	.7	.8	.9	1.0	1.2	85.	998
990	87.5	.1	.2	.3	.5	.6	.7	.8	.9	1.0	87.5	990
992	90.	.1	.1	.2	.4	.3	.6	.7	.8	.9	90.	992
994	92.5	..	.1	.2	.3	.4	.5	.6	.7	.8	92.5	994
996	95.	..	..	.1	.2	,3	4	.5	.6	.7	95.	996
998	97.5	..	..	..	.1	.2	.3	.4	.5	.6	97.5	998

The instrument in its complete state is made and sold by Mr. Joseph Long, Little Tower-street. The Tables, of which the above is only a portion, and the barometric indicator have been constructed by him and Mr. Atlee.

98, Bloomsbury-square, Sept. 20, 1847.

Digitized by Google

SAFE MODE OF WORKING THE TUBULAR BRIDGES.

Sir,—In reference to the mode of raising the Britannia Tubular Bridge, (proposed in Number 1264, of your valuable Journal), it is purely an engineering question, and one which principally belongs to the engineers employed in its construction, although doubtless the eyes of the scientific world are turned towards that bold and novel experiment.

There are, however, two very important questions connected with this subject. First, as to the expense of construction. Second, the stability of the structure when completed. The former question affects the pockets of the shareholders of the undertaking, and the latter has reference to the safety of the lives of the passengers who may feel disposed to patronize the line when completed.

I beg to propose, through your widely circulated Journal, a plan which will go far to save the pockets of the shareholders, (so much wanted at the present moment), and, to a still greater extent, tend to preserve the necks of the enterprising travellers.

As the plan of the proposed tubular bridge is upon a novel principle, and the calculations as to strength based upon experiments made with models, it cannot be doubted but the greatest caution will be exercised. Engineers and experimenters are well aware of the fallacious results of formulæ deduced from models, and of the important fact, that, however trustworthy a formula may be within certain limits, it may nevertheless lead to fatal results when carried to an extreme.

The most destructive element in all railway works is unquestionably vibration, whether as affecting the permanency of the slopes of cuttings and embankments, or the stability of bridges, viaducts, and tunnels, and it is quite clear that model experiments can furnish no data by which to calculate the destructive effects of the vibration caused by a railway train at a high velocity. Nor does experience prove that engine-drivers can, under all circumstances, and in all states of the weather, be depended upon to adhere strictly to any prescribed rate of speed.

I would therefore propose, as a matter of economy, to make use of only one tube and one set of rails; and to prevent two trains from meeting in the tube, I would suggest that no locomotive should be allowed ever to pass through the tube with a train attached, but that the trains in each direction shall be drawn by stationary power, or perhaps it would be no difficult matter so to arrange rope-machinery, with revolving cylinders, as to bring the driving-wheels of the locomotive over these cylinders, and by the action of the engine (which being placed on a revolving cylinder could not progress) give motion to the rope-machinery and thus save the expense of stationary power.

By this arrangement, also, the stability of the structure and the safety of the passengers would not be endangered. The weight of the locomotive would not have to be borne by the tube, and the motion of the train would necessarily be so slow as not to generate any destructive vibration.

In adopting two tubes they cannot be any mutual help, unless they are attached to each other, and if so attached, the combined effect of the vibration caused by the passing of trains in opposite directions, may prove much more destructive than can be anticipated; and should it be said that it is not intended to allow two trains to pass each other on the bridge, it will then follow as a matter of course that one tube is as good as two for all useful purposes.

I am, Sir, yours, &c.,

A.

SIMPLE METHOD OF COMMUNICATION BETWEEN ENGINE-DRIVERS AND PASSENGERS.

Sir,—I am a constant traveller by rail, and have read with much interest in your Magazine, the different methods proposed for communicating to the engine-driver any mishap occurring to the train behind him. The following suggested itself to me long before anything was written on this subject, and appears still, to me, to be the most simple, most efficacious, and the least expensive of any hitherto propounded.

Let every carriage, whether first, second, or third-class, horse-box, luggage-van, or goods'-truck, be fitted with a cord of gutta percha, (the same as is now used to drive lathes,) having at each end a spring hook, which hook, when once attached, shall form a continuous pull to a

Digitized by Google

bell on the tender, or the handle of a whistle on the engine. The line may be carried just under the roof of the carriage, through rings here and there, and was then available to any one reaching out of window; or, if that is objectionable, carry it through a slight tin tube, and it can then only be touched by the guards, (of course every engine would carry its piece of line, ready to be hooked on to the first carriage).

By this method it will be seen that the communication-line may be unlinked by the same man who detaches the carriages; and in the same way a carriage may be brought into the very centre of a train, and the communication-line hooked to the one in front, and the one behind form a direct pull to the engine as before. Likewise, if part of a train got detached by the screws parting, the line would then self-act, at the moment before breaking, and sound its own alarm. The guards, on finding anything amiss, would only have to pull up the little slack of line that there would necessarily be by this method, and immediately communicate to the engine-man, whose positive orders should be, "whenever that alarm (whatever it be) sounds, stop at once." I grant, it might be a frivolous stoppage now and then, but in the end the public would be the gainers.

I beg, in conclusion, to say I am constantly using your Magazine for reference to patents and other valuable matters, and when I see others trying to prescribe for the public good therein, it prompts me to send you the foregoing remarks, and which the railway world are at liberty to adopt if they see any good in the plan.

I am, Sir, yours, &c.,
VIATOR.

RAILWAY BUFFERS.

Sir,—I am perfectly aware that *buffers with plane or flat surfaces* will have *nearly* the same tendency to ride that the ordinary buffers have; but I did not suggest such buffers. What I have suggested is, that the buffers of one carriage should abut upon the perfectly plane surface of the frame, or most solid part of the next carriage. And I beg to submit that such buffers could not by any possibility have "just the same tendency to ride" as the buffers in ordinary use.

I am, Sir, yours, &c., S. Y.,
An Engineer.

8th Nov., 1847.

INQUIRIES AND ANSWERS TO INQUIRIES.

Organ Pipes.—Sir,—As I observe questions asked and answered in your valuable Magazine on all sorts of subjects in the least connected with mechanics, I think it possible that some one among your contributors will kindly favour me with information on a matter in which I am at a great loss for it. I have for some time had it in contemplation to build a musical instrument, into which I wish to introduce several stops analogous to those in an organ. My first difficulty is, want of information as to the construction of a scale of widths for metal open diapason-pipes. Suppose a pipe, one foot long and one inch in diameter, gives C, a pipe double the length will give CC; but what should be its relative diameter? In short, in what ratio to the length should the diameter of the bore increase? I am also anxious to know—supposing it is desired to increase or diminish the scale of *lengths*—in what proportion the corresponding scale of *widths* will require to be diminished or increased? For example, one foot of length, with one inch bore, will give C; but it is wished to make C only nine inches long: what increase of diameter will be required to give the same note? In other words, the speaking *length* of C pipe being given, how must a scale be constructed that will at once indicate the *width* necessary to produce the note? Wood pipes appear to give the best tone when not perfectly square, but oblong. I should be glad to know the best proportions for them. I am perfectly acquainted with the structure of open and stopped diapason pipes, both wood and metal, when completed; but, as to the *modus operandi*, I am greatly at a loss. I can manage to solder a zinc tube together, after a fashion; but my metal pipes are sad, clumsy affairs, and I am perfectly puzzled to conceive how the beautiful neat seams on a few old pewter pipes, out of a small hand-organ which I bought, have been accomplished. Any hints on the practical construction of metal pipes and reed stops, scale of dimensions, &c., of reeds or tongues for seraphine, and methods of tuning them, I should be most grateful for; and if, Sir, you will have the goodness to insert this letter in your useful Magazine, I have great hopes that some one will kindly assist your obedient servant, A MECHANIC.—Bantry, October 30, 1847.

Roman Cement.—"Wherefore *Roman?*" *A Builder.* It was so called, we believe, from a mere whim of the first patentee, Parker. It is one of our own native water cements, and a better cement than Rome ever possessed. Even in this country it is but half a century old. Parker's patent was dated 28th June, 1796.

Digitized by Google

Weaving.—I shall feel much obliged if you will inform me which is the best work on weaving, or on silk and cotton manufactures generally; and also if I can get small reels or bobbins in London, and where? I remain, &c., "SHUTTLE." White's "Practical Treatise," Glasgow, 1846, is by far the best yet published. We purpose giving an account of it in an early number. There are not many good bobbin-makers in London, but our correspondent will probably obtain what he wants at Hancock's, Thomas-street, Brick-lane.

Cooling.—Water may be cooled many degrees below the freezing point (32°) without being frozen or converted into ice; and this explains the apparent "anomaly" which has excited the surprise of "Aquarius." Deluc cooled it down to 14° below 32°; Blagden, to 12°; Walker, to 22°. When reduced to these very low temperatures, however, the instant it does freeze, it starts back to 32°, as if it actually required to be somewhat *warmed* before it could become *ice*.

Gold Watch-cases, when of standard quality, should contain 18 carats of fine gold and not more than 6 of alloy. No gold of inferior quality ever receives the Hall mark.

Electrotype Plating.—Messrs. Elkington and Co. have, we believe, quite abandoned the processes which go by their name, and now do all their work by the electro-magnetic process of the late Mr. J. S. Woolrick. "P. B." will find the latter fully described in our Journal for 25th Feb., 1843, No. 1020.

Mathematical Exercises.—It is our intention to resume the solutions at no distant period. We shall also give the analysis of the problems of "Lineal Section," the constructions of which were published nearly half a century ago in the *Liverpool Student*: but we fear that they must be delayed a little longer. The idea of such a mathematical periodical as our friend Mr. Wilkinson suggests, is one which has often been mentioned to us; but we are convinced that it could only be conducted at considerable pecuniary sacrifice. Not one of the *purely* scientific periodicals of the age could be maintained were they conducted with reference to emolument.

MATHEMATICUS wishes to be supplied with the dates of the English periodicals which have been more or less devoted to mathematics. Perhaps some of our friends may be able to give them; and if any particulars respecting management, editorship, &c., could be added, it would be, as our correspondent remarks, "of great use."

WEEKLY LIST OF NEW ENGLISH PATENTS.

George Henry Bursill, of Hornsey-road, Middlesex, and Joseph Radford, of Maida-hill, for improvements in envelopes, wrappers, and covers, and in machinery and apparatus for the manufacture thereof. November 6; six months.

John Robertson, of Tweedmouth, Berwick, gentleman, for improvements of architecture, the elementary method of formation employed in the same; also further applicable for harmonizing formation, as of urns or vases. Nov. 9; six months.

Henry Fielder, of Carlton-villas, Maida-vale, Middlesex, for improvements in the construction of iron beams or girders. November 9; six months.

Edward Wand, of Bradford, Yorkshire, spinner, for certain improvements in the construction of machinery for preparing and spinning alpaca, mohair, wool, flax, and other fibrous materials. November 9; six months.

George Heaton, of Birmingham, engineer, for improvements in locomotive engines. November 9; six months.

Henry Krebs Claypole, of Liverpool, gentleman, for certain improvements in the process, apparatus, and machinery for making sugar. (Being a communication.) November 9; six months.

Joseph Jean Baranowski, of 8, Rue Neuve Clichy, Paris, gentleman, for a ready-reckoning machine. November 11; six months.

Israel Kinsman, late of New York, but now of Ludgate-hill, London, for improvements in the construction of rotary engines, to be worked by steam, air, or other elastic fluids. Nov. 11; six months.

Frederick Collier Bakewell, of Hampstead, Middlesex, gentleman, for certain improvements in machinery, or apparatus, for making or manufacturing soda-water, and other aerated waters. November 11; six months.

Samuel Salmon, of Houndsditch, Middlesex, manufacturer, for improvements in rendering certain materials applicable as a substitute for leather, paper, papier maché, and oil-cloth, in various articles of manufacture. (Being a communication.) November 11; six months.

George James Soward, of Huntley-street, Bedford-square, gentleman, for improvements in suspending windows, sashes, shutters, and blinds, and in the construction of the frames for the same. (Being a communication.) November 11; six months.

Charles Blachford Mansfield, of Clare-hall, in the University of Cambridge, Esq., for an improvement in the manufacture and purification of spirituous substances, and also applicable to the purposes of artificial light and various useful arts, and in the application thereof to such purposes, and in the construction of lamps and burners applicable to the combustion of such substances. November 11; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Designs.
Nov. 3	1253	Thomas Attwood	Lewes, Sussex	Singing apparatus.
9	1254	Joseph Collins	Birmingham	Indian-rubber holder.
„	1255	Brown, Marshall, and Co.	Birmingham	Ventilator for railway and other carriages.
„	1256	Richard Sharp	Westmoreland-street, Dublin	Horological tell-tale.

Digitized by Google

Gutta Percha Company, Patentees,

Wharf-road, City-road, London.

October 1, 1847.

THE GUTTA PERCHA COMPANY, in requesting the attention of the Public to the accompanying Testimonials, have great pleasure in stating that the steadily increasing demand for the PATENT GUTTA PERCHA DRIVING BANDS justifies the utmost confidence that they are fully approved.

Their durability and strength, permanent contractility and uniformity of substance—their insusceptibility of injury from contact with Oils, Grease, Acids, Alkalies, or Water, and the facility with which the single joint required can be made in Bands of an indefinite length, render them superior for almost all working purposes, and decidedly economical.

Galoshes, Tubing of all sizes, Bougies, Catheters, and other SURGICAL INSTRUMENTS; MOULDINGS FOR PICTURE-FRAMES and other decorative purposes; WHIPS and THONGS, TENNIS, GOLF, and CRICKET BALLS, are in a forward state of manufacture, and will be very shortly ready for sale.

All orders forwarded to the COMPANY'S WORKS, WHARF-ROAD, CITY-ROAD, will receive immediate attention.

Haslingden, September 4, 1847.

Dear Sir,—We have now been using the Gutta Percha Straps for the last eight months, and have great pleasure in saying they have answered our most sanguine expectations; and we may add, that some of our machines which required a 12-inch leather strap, and which almost daily required to be repaired, we have been turning the same with the Gutta Percha Straps 10 inches only for the above-named period, and now find them as good as the day they were first applied.

We remain, yours respectfully,
W. & R. TURNER.

To S. Statham, Esq., Gutta Percha Company.

Atlas Works, Manchester, Sept. 1, 1847.

Sir,—In reply to your inquiry as to the result of our experience with the Gutta Percha Straps, we have great pleasure in stating that the advantages they possess are so very manifest as to induce us to apply them in almost every instance where new straps are required.—We are, Sir, very respectfully,
SHARP, BROTHERS.

Samuel Statham, Esq., Gutta Percha Company.

Bridgewater Foundry, Patricroft, near Manchester, Sept. 3, 1847.

Sir,—In reply to your inquiry respecting how we like your Gutta Percha Machine Straps or Driving Belts, although we have not had quite so much experience in the above-named use of Gutta Percha as we hope to have, so far as we have employed it, it has given us general satisfaction. The beautifully straight and regular manner in which it runs on the pulleys, especially on our cone or speed pulleys, is a strong recommendation in its favour; and although we are inclined to think it does not take so fast a grip on the pulley as leather, yet there is ample hold for all general purposes. We shall continue to use it and to give it our best attention, so as to learn how to employ to best advantage the many excellent qualities it possesses over the ordinary leather belts.

NASMYTH, GASKELL, & CO.

S. Statham, Esq., Gutta Percha Works, London.

Manchester, 18th June, 1847.

Dear Sir,—We beg to inform you that we have now had the patent Gutta Percha Bands or Straps in use for more than six months. For tube frames we consider them very much superior to anything we have tried before. They also do very well as open straps for mules, throstles, looms, &c.

We are, Sir, yours respectfully,

THOS. DODGSHON & NEPHEWS.

Mr. Samuel Statham, Gutta Percha Company.

Wellington Mills, Stockport, 4th September, 1847.

Gentlemen,—We have much pleasure in bearing our testimony to the valuable qualities of the Gutta Percha for driving bands. We have found it answer exceedingly well in most cases where we have tried it, and we think it has only to be made known to ensure its very general use.

We are, Gentlemen, yours obediently,

HOLE, LINGARD, & CRUTTENDEN.

To the Gutta Percha Company, City-road, London.

Tottington Hall, near Bury, Lancashire, September 3, 1847.

Dear Sir,—Your letter of the 31st August is to hand, and in answer respecting the use of your Gutta Percha Bands, I cannot give you a better proof of our approval of them in preference to leather straps, than having given an order for another to your partner, yesterday, to be in readiness in case of accident. They are decidedly preferable to the old straps; and we can recommend them with the greatest confidence to any person for Driving Straps.

For HALL & GORTON, THOMAS GORTON.

S. Statham, Esq., Gutta Percha Company.

Brewery, 16th September, 1847.

Gentlemen,—We have much pleasure in repeating our testimony to the very great improvement effected by the use of Machinery Bands made of your material instead of leather: the stoppage of parts of our works, through the failing of the leather straps, used to be of daily occurrence, causing great inconvenience and expense. With this annoyance we are now never troubled, and are assured by our superintendent that the advantage of using your material is surprising, as regards economy and saving of trouble. We confidently recommend it to machinists and factories for general adoption.

TRUMAN, HANBURY, BUXTON, & CO.

To the Gutta Percha Company.

Patent Gutta Percha Soles for Boots and Shoes.

The capabilities of the GUTTA PERCHA SOLES FOR BOOTS AND SHOES having been extensively and satisfactorily tested, we can unhesitatingly recommend the material prepared for the purpose, its merit having been acknowledged by all who have worn it. Indeed, experience has proved that Gutta Percha Soles wear twice as long as leather, with great additional personal comfort, and they remain perfectly impervious to wet until quite worn through.

23, Southampton Row, 1st Sept., 1847.

Gentlemen,—I write to thank you for allowing me to use the new PATENT GUTTA PERCHA SOLES. I felt annoyed at not being allowed to use them from the time I had first worn them, namely, from last October, but am not sorry now, because I can speak confidently of their advantages over leather soles. I made the first pair last October, and wore them eight months before I wore the soles through. I had them heeled six times, and one pair of extra fronts I put to the same soles. *I only kept the one pair in wear to see how long they would last.* I will never wear another leather sole so long as I can get GUTTA PERCHA SOLES, and I walk from 12 to 20 miles a day.

C. WRIGHT, Boot and Shoe-maker.

To the Gutta Percha Company.

9, Gloucester Row, Hoxton, 5th July, 1847.

Sir,—I beg to thank you for the boots with GUTTA PERCHA SOLES which I had from you on the first of the year. I have had them in constant use for nearly five months, the greater portion of that time being the most inclement period of the

Digitized by Google

year; and from my occupation as a general post letter-carrier, you may be sure that they have had more than a common fair trial, and the Gutta Percha seems now as firm and as little worn as on the first day. W. HUTTON, G. P. O. Letter Carrier.

To E. Granville, Esq., Gutta Percha Works.

28, St. John-street, August 25th, 1847.

Gentlemen,—It gives me great pleasure to acquaint you that the Gutta Percha Soles I had from your Works have answered the purpose admirably, as I can fully testify, having had them in wear six months, during the winter, in Smithfield-market, and have not been subjected to the annoyance of wet feet, as is often the case with leather soles, and, in my opinion, they wear three times as long.

H. I. TARLING.

To the Gutta Percha Company.

N.B.—The above Soles, which are not worn out, may be seen at the Gutta Percha Company's works.

No. 3, Union place, New-road,

Dear Sir,

I have worn the Gutta Percha Soles for nearly a year, with much satisfaction and comfort: in wet and cold weather they keep the feet perfectly dry and warm—are pleasant to wear, and I have found them more durable than leather.

I am, Dear Sir, yours faithfully,

W. GORTON.

To the Secretary of the Gutta Percha Company.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3d.; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Patent Bells.

MESSRS. MEARS beg to call the attention of the Trade and the Public generally to these articles, which they are now prepared to supply in any quantity and variety. The composition is of a new metal, called the Union Metal, and the bells are of very beautiful tone, and cheaper than those made of the ordinary bell metal. Orders received at the Bell Foundry, Whitechapel, for house, cattle, and other bells.

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs. T. Burnell and Co., 1, Great Winchester-street, London.

Just Published,

Price Sixpence,

A Familiar Description of a Wooden Bridge, and the Tube and Valve for an Atmospheric Railway; with full directions to the workmen, showing how these articles are to be manufactured. By Henry Charles Lacy, Esq., M.P. October, 1847. London: Whittaker and Co. Bodmin: Liddell and Son.

NOTICES TO CORRESPONDENTS.

Mr. Adcock's reply to Cassell Morlais and other correspondents is unavoidably deferred till our next; as is also the further notice promised of Mr. Simpson's Submerged Horizontal Propeller.

Communications received from *B. B.—Sector—T. S. N.—Vectis—An Occasional Reader—Querist—A.*

CONTENTS OF THIS NUMBER.

Description of Brooman's Patent Improvements in Turn-Tables—(*with engravings*) 467
Gibbon's Improvements in Trussing Beams and Girders 472
Geometry of the Line and Plane. By Professor Davies, F.R.S., L. & E., F.S.A., &c.—(*continued*) 473
A Plus and Minus Puzzle 475
Bourne's Catechism on the Steam-engine—(Review) 476
Effect of the Lines of Steam-vessels on their Speed 477
Description of Waller's Patent Coffee-pot—(*with engraving*) 478
Description of Field's Ebullition Alcoholmeter. By Dr. Ure, M.D., F.R.S., &c.—(*with engraving*) 479
Safe Mode of Working the Tubular Bridges 486
Simple Method of Communication between Engine-drivers and Passengers 486
Railway Buffers 487
Inquiries, and Answers to Inquiries 487
Weekly List of New English Patents 488
Weekly List of Articles of Utility Registered 488
Advertisements 489

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 165, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1267.] SATURDAY, NOVEMBER 20. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166 Fleet-street.

BRYANT AND TOTHILL'S TRANSPOSING PLOUGH.

Fig. 1[a].

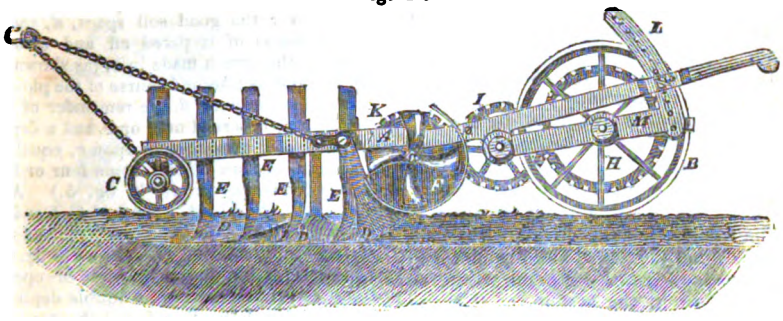


Fig. 2[a].

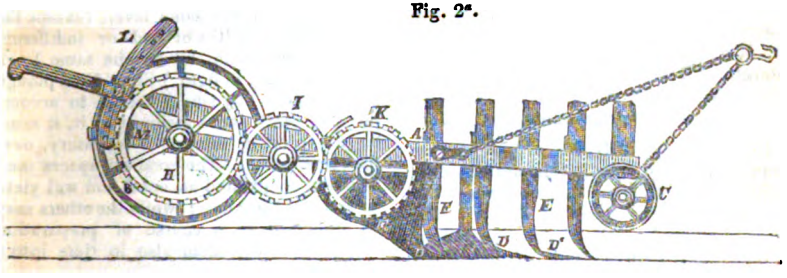
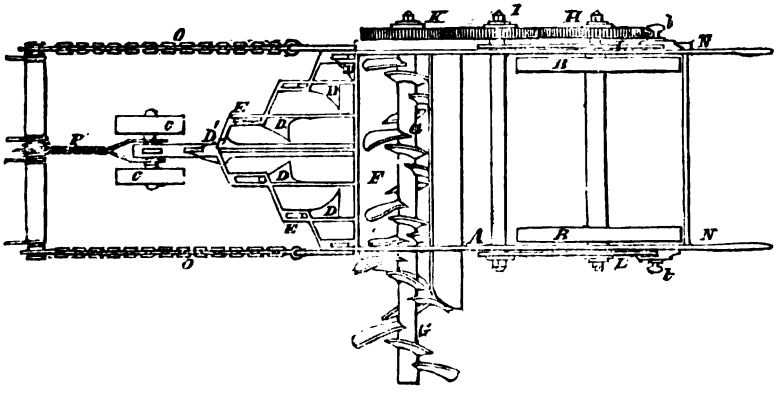


Fig. 3[a].



Digitized by Google

FIELDEN'S PATENT OSCILLATING CAN FOR THE RECEPTION OF COTTON SLIVERS, ROVINGS, ETC.

[Patent dated 8th May, 1847. Patentee, Joshua Fielden, Esq., of Waterside, Todmorden. Specification enrolled 8th November, 1847.]

When cotton, wool, flax, and other like fibrous matters are in the combed state, preparatory to being spun into thread, which state is variously designated by the terms slivers, ribbands, drawings, cardings, rovings, layers, &c., they are conveyed from the carding or other preparing machine into receiving cans or baskets, into which they fall in a series of convolutions with a very considerable degree of regularity. The object of the present invention is to cause the drawings (as Mr. Fielden, for the sake of convenience, calls in his specification, all matters in this combed or drawn out state) to lay themselves in the cans with still greater regularity, and at the same time to press them to a certain extent while in the course of laying and after they are laid; by which improvements, the drawings are rendered less liable to be stretched or made uneven, in the process of removing them from the cans, and the spinner is enabled to produce from them a much more perfect thread.

Fig. 1 is a front elevation of the machinery by which this is effected; and figs. 2 and 3 are elevations of the two ends of it. The following is Mr. Fielden's description:

A A, is a strong framework of metal which is fixed securely to the floor of the apartment in which it is set, and in close proximity to a carding or other like engine; B B, is a second frame of metal which oscillates or swings in bearings in the fixed frame, A A, and holds the can for receiving the drawings, which is kept in its place by the turn-button fastenings, I I; D, is a pulley fixed on the roller-shaft of the carding or other like engine, which gives motion to a second pulley, E, through the medium of a belt, F. On the spindle of this latter pulley, E, there is a crank which is connected by a rod, G, to the back of the oscillating frame, B B, so that when the pulley, E, is put in motion, the frame, B B, is made to oscillate. K, is a pulley fixed upon the same shaft of the carding or other engine as the pulley, D, which communicates by the belt and pulley, L L, a rotary motion to a pair of calender rollers, M M, which have their bearings in the fixed framework, A A: N is an eye, or guide, through which the drawings pass, and which is made to traverse longitudinally on the top rail of the frame, A A, (immediately over and parallel with the calender rollers, M M,) by means of the arrangements next to be described. O, is a pinion fixed upon the spindle of one of the calender rollers, M M, which gears into a larger wheel, P, which again gives motion to a belt, Q, running over two small pulleys, R R. To the outer edge of this belt there is attached one end of a cord, S, the other end of which is secured to the eye, N, so that while the end of the cord which is attached to the belt, Q, is descending, the eye, N, moves from left to right, (through the action of the cord, S,) but when it is ascending, the action of the weight, T, causes it to move in the contrary direction: U U, are a pair of pressing-rollers which have their bearings in the upper part of the fixed frame, A A, and receive an alternating rotary motion from a segmental rack, V, which is fixed to and forms part of the oscillating frame, B B, which gears into pinions, W W, affixed to the spindles of the pressing-rollers.

In operating with this machinery the drawing is first passed over a cylindrical beam, X, (made of thin sheet metal,) and then through the eye, N, and down between the calender rollers, M M, whereby the drawing is so consolidated as to admit of its being closely packed into the can and made better able to bear uninjured the subsequent process of withdrawing upon the can.

The parallel motion of the guide, or eye, N, together with the oscillating of the frame, B, causes the drawings to fall into the can in regular and uniform layers, while the rollers, U U, serve to press them down into the can.

GENERAL SIR SAMUEL BENTHAM'S PLANS FOR RENDERING WATER-WORKS SUBSIDIARY TO THE EXTINCTION OF FIRES.

Sir,—Means of connecting fire-extinguishing works with water-works seeming now an object of interest, the following account of works for this purpose, devised by the late Brigadier-general Sir Samuel Bentham, may perhaps be interesting to some of your readers; and his proposal for the introduction of analogous works

Digitized by Google

for the better security against fire of the metropolis, may indicate a variety of details essential in the carrying such a scheme into efficient execution.

So long ago as 13th February, 1797, Sir Samuel stated to the Admiralty, that "considering the immense losses which have been sustained in consequence of the devastation of repeated fires in his Majesty's dock-yard at Portsmouth," and "how very ineffectual to the suppressing fire among the inflammable stores in a dock-yard, any quantity of water must be that can be thrown by means of any of the engines in use," he proposed, in the first place, the obtainment of an ample supply of fresh water, for ordinary purposes, by the sinking of deep wells, and the making provision that the water, in case of fire, should be applied, by means of a new arrangement, to the speedy extinction of the conflagration.

For this purpose, he proposed that tanks should be formed on the tops of some of the highest buildings in the dock-yard; that pipes of a large diameter should be laid from those reservoirs to all parts of the yard where buildings of importance were situated, or where ships could lie; that branches, prepared for the ready affixture of a hose, should rise from those pipes, and from which, water could be thrown upon any building *without the intervention of any fire-engine*, the water being raised by pumps worked by a steam-engine. He also proposed extending the pipes to the gun-wharf, the victualling premises, the barracks, and other public establishments, adding, that "the reasons for affording that security to the naval establishments near Portsmouth, seem to apply equally to *all other establishments* in proportion to their importance."

Dread of mischiefs that might result from the introduction of a steam-engine into a naval arsenal, he knew to be strong, and therefore confined his first proposal to a very limited extent of apparatus compared to what he had in view; yet the prejudice against that *primum mobile* prevented a decision on the measure till the middle of the following year. The well was not completed before 1801, when, (September 27th,) Sir Samuel proposed in detail a system of fresh water delivering and fire-extinguishing works, so as to convey water to every part of the dock-yard through pipes of eight and six inch bore; he further proposed a pump capable of forcing two tons of water per minute through those pipes to any part of the dock-yard, and to a height sufficient to throw that quantity of water over the highest building in the yard, or over the highest ship in the basin, on the slips, in dock, or at the wharf side; that pump to be worked by either of two 30-horse-engines in use night and day. The mains were so contrived that water could flow through them by each of two different courses, so that in case of accidental injury or stoppage in any part, the flow of water would still be uninterrupted in the other course: the 6-inch mains were so contrived that water could flow through them by two different courses to any part of the yard, so as to give a supply of water at any point to the full bore of the 8-inch main.

In case of insufficiency of fresh water, provision was made for supplying its place with salt water from the great basin.

Shortly after his return from his mission to Russia, he, on the 9th April, 1808, described to the Navy Board these works as then completed. The water kept in the high cisterns over the wood mills amounted to 320 tons; that in a lower cistern, for ordinary uses, to 90 tons. In the wood mills, on account of the inflammable nature of the refuse there, and because, in addition to this danger, the steam-engines for raising water were in the same building, he caused to be introduced in the interior of each room pipes, each prepared as for a hose, kept always in readiness to be screwed on, so as to be instantly available for throwing water with force on any point where fire might break out.

In addition to the power of the steam-engine, he, at the suggestion of commissioner Sir Charles Grey, devised a forcing-pump, to be worked by 30 men, from which the water should flow into the same pipes as from the engine-pump. The whole apparatus, with the exception of a standard to receive capstan-bars, was *under* ground, so as not to occupy valuable space in the yard.

It happened not to be before 25th June, 1810, that Sir Samuel had leisure to cause these works to be set in motion in his presence; the following note is copied from a journal written at the time:

Digitized by Google

"The steam-engine working the forcing-pump, with four hose screwed on to four fire-plugs. The hose threw the water over the wood-mills, and thence over the chimney coming up from the blacksmith's shop over the reservoir."—"The horizontal distance to which the water was thrown was 110 feet from the nozzle, by measurement; by estimate it was thrown perpendicularly to a height of 60 feet, when a man stood on the ground to guide the pipe; but when the man took the pipe to the top of the wood-mills, the water was thrown to the height of 70 feet from the ground. Six hose can be worked at the same time."

Another circumstance noted seems of importance, namely, that on trial of a hose screwed on to a pipe at a very distant part of the yard, the jet was equal to that by the side of the wood-mills; from which it appears that the great loss by friction in passing far through ordinary hose, does not take place in a material degree when water is forced through well made metal pipes of large bore.

In Plymouth dock-yard, where Sir Samuel introduced works of the same nature, fresh water was delivered at a height which would command the important parts of the yard without the intervention of a steam-engine. The forcing-pump for raising water from the harbour, here, as at Chatham, was designed to be worked by from 60 to 80 men, whose force applied to the 16 bars of the capstan, at a pace of 2½ miles per hour, was calculated to raise a ton of water per minute, under an initial resistance equal to the pressure of a column of water of 200 feet.

The success of the water and fire-extinguishing works in those dock-yards, has led to the introduction of similar works in other naval arsenals. Sir Samuel proposed them on a very extensive scale for Sheerness; but on the abolition of his office, this was lost sight of, till Mr. Mitchell, the present engineer of that dock-yard, proposed and succeeded in introducing them. This gentleman was of Sir Samuel's establishment of millwrights in Portsmouth dock-yard, and by him was selected to superintend the erection of the water-works at Plymouth. While Mr. Mitchell was so occupied, an extensive conflagration broke out in the rope-house, on which occasion he noticed the great advantage of a large jet or *dash* of water in extinguishing fire over many small jets. The principal main he has laid at Sheerness is of 12-inch bore, instead of eight, as at Portsmouth; he has bestowed great attention on the pumps, air-vessels, and other appendages, and has provided hose even larger than those at Portsmouth. In other respects, the arrangements at Sheerness are of a similar nature with those at Portsmouth.

Sir Samuel was from 1814 many years absent from this country, but soon after his return he had the satisfaction to learn that on several occasions his fire-extinguishing works had been of eminent service when fires had broken out; and on the 26th June, 1827, the mechanist of Portsmouth Dock-yard wrote to him that his letter had been shortened in consequence of an alarm of fire in a ship along side the settle, but "the fire was very soon extinguished by means of the water pipes."

Several destructive conflagrations having taken place in London soon after Sir Samuel's return, his attention was drawn to the subject, and he drew up a proposal for the better protection of the metropolis against fire. He observed in his paper, that as in regard to Portsmouth dock-yard the efficacy no less than the economy of the works in question, depended on their being combined with the water-works, and with the steam-engines for manufacturing purposes, so in regard to the metropolis, works already existing might be made the basis of the plan he had to suggest.

He observed that most of the water-works of the metropolis had means of raising water to a reservoir high enough to force water in a jet from the mains as high as the first-floor of all houses, and to the second, and even third floors of those in the lower parts of the town,—That there were two ways by which this existing apparatus might be adapted to extinguishing fire; first, by an alteration of the fire-plugs in the streets, such as should enable hose to be screwed upon them, so that by this means water might be thrown in a jet as large as these plugs would furnish; secondly, by adapting in the front of every house where it might be thought desirable lesser screw-plugs ready for screwing on a hose. But as the reser-

Digitized by Google

voirs would not force a jet over the tops of the higher buildings, water might be thrown to that greater height by the force of the steam-engines, already existing at the several water-works, in the same way as is done by the steam-engines at Portsmouth.

The expense attendant on these improvements would consist in the alteration of the plugs and the provision of suitable hose. The large ones, he supposed, might be a public concern, so far as that the expense would be to be paid either by subscription amongst insurance-offices, or included in the rate paid by inhabitants for the supply of water; but the smaller plugs and hose being peculiarly applicable to each particular house, at the first moment fire might be discovered, the provision of this apparatus might be optional with each householder, and a suitable hose, if desired, might be provided and kept on the premises themselves.

Sir Samuel adverted to the many existing wells in town capable of affording a great supply of water; and observed, that for raising it steam-engines and pumps were often on the spot, which by permission obtainable from the proprietary, might be connected with the general system of pipes, to act in addition to the apparatus at the water-works.

He said, that "in particular buildings of great value, or of a peculiarly hazardous nature—such as libraries, manufactories, and theatres,—an apparatus might be introduced in the interior, such as is above described as existing in the wood-mills. So also at any time forcing-pumps might be applied to any of the several public wells in the streets."

The General then proceeded, "that however well-contrived and efficient such a system of fire-extinguishing works might be in itself, there could be no dependance placed on it unless suitable regulations were adopted for insuring their prompt and certain application to use in times of need." And referring to two great fires which had then recently occurred, "it was notorious," he said, "that the destruction of such immense property had arisen from delay in the arrival of fire-engines, from want of water after they did arrive, and from want of presence of mind and experience in the persons first on the spot; that according to present arrangements, an irremediable source of delay in the procurement of water was, that the turncock of the division had to be waited for, before the plugs could be opened." To remedy this, means of turning on water should be in the hands of persons already on the spot—"such persons exist in the police."—"It may at first sight," he said, "bear the appearance of impropriety, or impracticability, that every police-constable should carry with him a turnkey; but in point of fact a policeman's staff, without being too cumbersome or heavy, might be made to answer this purpose; and if the very frequent occasions be called to mind when such delays have occurred to the great destruction of life and property, it may well be thought worth while not to reject a suggestion of this nature because it professes to effect an important purpose by very simple means."—"The larger hose and jets might be kept in appropriate receptacles, not too far apart, and openable by police-constables."

"Should street forcing-pumps be introduced, they, as at Portsmouth, should be *below* the pavement so as to be secure from frost; the means of working them might be by a capstan-post, with bars to put in in time of need, when men to produce an immense force could be easily collected."

In order to secure readiness for use, Sir Samuel thought that this system of works should be kept as much as possible in constant use for other purposes than extinguishing fire—for example, instead of sending carts about with water for watering streets, the fire-extinguishing hose might be employed for this purpose, and the business thus be effected at a much less expense than its present cost. He then observed, that it was desirable to introduce, and improve upon, a variety of minor apparatus used in foreign countries to preserve life and save property; and concluded by saying that the cost of carrying into execution such a plan as he had proposed would materially depend on the judiciousness of the means employed.

The above quoted letter, recommending the introduction of fire-extinguishing works in the metropolis, was by Sir Herbert Taylor, February 1830, communicated to Sir Robert Peel, and to other influential persons; but it was conceived that the Insurance Companies would oppose the measure, and altogether that

Digitized by Google

the public mind was not yet ripe for it. In the year 1844,—whilst the Bill was pending which Lord Lincoln brought into Parliament for the better Security of the Metropolis against Fires, Sir Samuel's widow took the liberty of submitting a copy of that letter to his lordship.

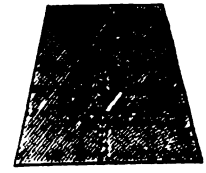
It may be hoped that the experience obtained in Her Majesty's dock-yards of the efficacy of such a system, together with the experiments lately made at Liverpool, may now be considered as convincing evidence of the increased security that would be obtained in the metropolis, by a judicious extension, on the same principle, of the existing waterworks to the purpose of extinguishing fire.

B.

STATEMENT OF EXPERIMENTS MADE ON THE RELATIVE STRENGTH OF CAST-IRON, CHILLED AND UNCHILLED, AT CRANE-FOUNDRY, ON JULY 21, AND AUGUST 23, 1847.

I. *Experiments of July* 20.

The bars upon which the experiments were made were two in number, and were run at the same time from the same pot of metal. One of the bars was cast in the ordinary method of green sand-casting, and of the following dimensions:—Width of top edge, ¼ an inch; width of bottom edge, 1 inch; depth, 1¼ inch; total length, 4 feet: width between the supports when proved, 3 feet 10 in. area of cross section 1.125 inch; weight, 13¼ lbs.



The chilled bar had exactly similar dimensions to the above; except that the width of the bottom edge was ⅛ths of an inch only, instead of 1 inch, this difference arising from the sudden cooling of the bottom edge, which was run upon a piece of cold iron in order to chill it, (the bottom edge being the only part chilled;) in consequence the area of the cross section was only 1.078, instead of 1.125, and the weight was 12 lbs. 13 oz. instead of 13¼ lbs.

Number of Experiments.	Load carried by the bar.			Deflection observed in decimal parts of an in.		Chilled bar deflects more than unchilled, by difference as under.	Remarks.
	cwt.	qr.	lbs.	Unchilled bar.	Chilled bar.		
1	..	3	4	.0	.0	·0	
2	1	3	4	.0	.0625	.0625	
3	2	3	4	.0625	.1250	.0625	All weights taken off, bars resumed their original position.
4	3	3	4	.125	.2187	.0937	
5	4	3	4	.25	.3125	.0625	
6	5	1	4	.2969	.3437	.0468	
7	5	3	4	.3125	.406	.0935	
8	6	1	4	.3437	.4687	.1250	
9	6	2	4	Broke.	·5321		3 ins. from centre.
10	7	0	4		.5321		
11	7	1	4		Broke.		¾ of an inch from the centre.

As the chilled and unchilled bars are of different areas, and consequently of different strengths; it will be necessary before comparing them, in order to find the results produced by chilling, to reduce the weights they are capable of bearing to the standard of one or other of their areas. It will be most convenient to reduce the area of the unchilled bar to that of the chilled bar; and since

Digitized by Google

solid cast-iron beams will carry nearly in proportion to their cross sections every thing else being the same, the strength of an unchilled bar of the same area as the chilled bar will be found as follows:— As the area of the large unchilled bar 1.125 inches is to the area of the smaller chilled bar 1,078 inches, so is cwt. 6.28, the weight borne by the large unchilled bar, to cwt. 6.01, the weight which would have been borne by an unchilled bar of the same area as the chilled bar. But by the process of chilling, the small bar was made capable of bearing a weight of cwt. 7.035 instead of cwt. 6.01, the weight it would have borne had it not been chilled; and in consequence it results, that the process of chilling the under edge of the bar gives a superior strength of 17 per cent. on the cross section.

II. *Experiments of August* 23.

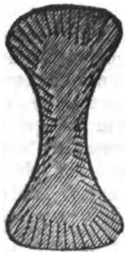
The bars upon which these experiments were made were all cast from the same pot of metal and at the same time; they were four in number; viz.: No. 1, cast in green sand; No. 2, in dry sand; No. 3, cast in a *chill;* No. 4, cast in a *chill* and afterwards annealed.

The total length of each bar was 18 inches, and the distance between the supports in each case 15 inches.

The figures below represent the sections of the bars, full size, as nearly as they could be taken:

No. 1.

No. 2.



No. 3.

No. 4.

Digitized by Google

TABLE, No. 1.

Col. 1.	Col. 2.	Col. 3.	Col. 4.	Col. 5.	Col. 6.	Col. 7.	Col. 8.	Col. 9.	Col. 10.
Number of bar.	Weight of bar.	Area of section.	Weight, if reduced to same area as bar No. 1, ·46 in.; col. 3, col. 2, col. 4.	Densities of bars, taking bar No. 1 as standard, 32·5 is to col. 4 as 100, col. 5.	Weight actually borne by each bar.	Weight each would have borne if reduced to area of No. 1, ·468 is col. 3, col. 6, col. 7.	Last column reduced to standard of 100, to show per centage.	Observed deflection or measure of elasticity.	Reduced to standard of 100.
	Ounces	Inches.	Ounces.	—	Lbs.	Lbs.	—	Inches.	—
1	32·5	·468	32·5	100·	1232	1232	100·	·130	100
2	30·5	·407	35·0	107·3	1008	1159	94·	·114	87
3	34·75	·428	37·9	116·7	784	857	69·5	·053	40
4	34·5	·444	36·3	111·7	2520	2656	215·0	·148	114

With regard to the formation of Table No. 1, there will be no remark necessary as it explains itself, excepting merely to observe that it appears from it that green sand castings are 6 per cent. better than dry sand, and 30¼ per cent. better than chilled ones without annealing; and, lastly, that by the process of chilling and annealing, 115 per cent. is added to the strength of cast-iron in respect of ability to resist impact.

Although from the smallness of the bars experimented upon and their bad section for comparison with the experiments of others, yet the above are quite sufficient to show the vast superiority of cast-iron treated in the manner described for No. 4, and the advantage resulting may safely be looked upon as very little less than 100 per cent.

It may also be well to observe, that these experiments show that the density of cast-iron is by no means a criterion of its strength.

With regard to the table of experiments, the method adopted in order accurately to measure the deflection was by having a cord from the bar under trial passed over and secured to a brass drum exactly 4 ins. in circumference; from the centre of the drum-axle a large circle was described, the quadrant of which was divided into hundredths, and a pointer fixed on the drum consequently indicated with great nicety the most trifling deflection.

It may also be remarked that column 5 is the comparison of the deflection of bar No. 4 with Nos. 1 and 2 only: No. 3 not being a sample of common casting, and therefore not included in the average.

With regard to the microscopic appearance of the sections, No. 1 presents much the same appearance at the top as at the bottom of the section, excepting that in the lower part the fracture of the iron seems more open, but nothing like a crushed appearance is observed towards the top. The fracture in this bar is about a ¼ of an inch from the centre, and goes through nearly in a straight line and at right angles with the horizontal line.

No. 2.—With regard to this bar exactly the same remarks apply to it as in the case of No. 1, excepting that the fracture took place in the centre between the ends of the bar.

No. 3.—The fracture of this bar presents a very singular appearance; it is highly crystallized, and the granular structure instead of being homogeneous, as in the former cases, appears to be

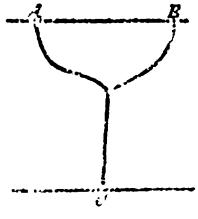
Digitized by Google

made of crystallized threads radiating from the centre of the curves which form the profile of the section. An attempt to represent this appearance has been made in the engraving of this section (No. 3.) It broke with a straight fracture ⅛ths of an inch from the centre of the bar, and about a ¼ of an inch out of the perpendicular line in the width of the bar.

TABLE, No. 2.

Col. 1.	Col. 2.			Col. 3.				Col. 4.	Col. 5.	
Number of Experiments.	Load carried by bars.			Deflections observed in decimal parts of an inch.				Average deflection of No. 1 and 2.	Inferior deflection of No. 4, with same weight.	Remarks.
	cwt.	qr.	lbs.	No. 1.	2.	3.	4.			
1	1	0	0	·0	·0	·0	·0	·0	·0	
2	2	0	0	·02	·02	·005	·01	·02	·01	
3	3	0	0	·035	·035	·0175	·0225	·02	·013	
4	4	0	0	·05	·0525	·0236	·0365	·035	·015	
5	5	0	0	·065	·075	·0370	·0535	·051	·016	
6	6	0	0	·0775	·0875	·0420	·065	·070	·017	
7	7	0	0	·09	·0975	·053	·0665	·082	·027	
8	8	0	0	·1025	·1084	Broke.	·0680	·093	·037	
9	9	0	0	·1125	·1140		·075	·105	·038	
10	10	0	0	·1213	Broke.		·08	·113	·041	
11	11	0	0	·13			·087	·121	·043	
12	11	2	0	Broke.			·09	·13		
13	12	0	0				·95			
14	12	2	0				·1			
15	13	0	0				·105			
16	13	2	0				·11			
17	14	0	0				·115			
18	14	2	0				·12			
19	15	0	0				·1285			*Weight removed and bar resumed its horizontal line. ** Weight put on again and deflections presented.
20	16	0	0				·1325			
21	17	0	0				·14*			
22	18	0	0				.12**			
23	19	0	0				·125			
24	20	0	0				·13			
25	21	0	0				·141			
26	22	0	0				·1475			
27	22	2	0				·1480			
28							Broke.			

No. 4.—At the moment of fracture this bar broke in two places, the one a simple fracture about 5 ins. from the end and nearly at right angles to the plane of the bar, and the other a compound fracture about a ¼ of an inch from the centre, and represented in the adjoining figure; A, B, C, representing the line of centre fracture. The iron had completely lost the crystallized appearance of No. 3, and had resumed the granular structure of Nos. 1 and 2, excepting that the grains are much finer and look more



like the fracture of cast-steel than cast-iron.

ROBERT BOWMAN.

Digitized by Google

GEOMETRY OF THE LINE AND PLANE.—BY T. S. DAVIES, F.R.S., & E., F.S.A.,
ROYAL MILITARY ACADEMY, WOOLWICH.

(Continued from p. 675.)

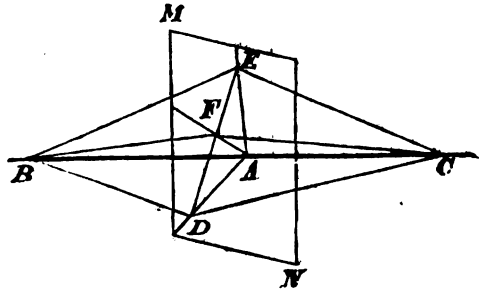
CHAP. III.

Inclination and Perpendicularity.

PROP. XXIV.

If a straight line be perpendicular to a plane, it will be perpendicular to every straight line in that plane which passes through the intersection of the perpendicular line and plane.

Let BAC be a line cutting the plane MN in A, and making right angles with the two lines AD, AE in the plane MN; and let AF be any other line MN drawn through the point A: then BAF will be a right angle.



For make AB, AC on opposite sides of the plane MN equal, and take any points D, E, F in the lines AD, AE, AF, so that they shall be one line; and join BD, DC, BE, EC, BF, FC.

Then, since BA, AE are equal to CA, AE, and the angles BAE, CAE also equal (being right angles), we have BE equal to EC. In a similar manner BD, DC are equal. (*Euc. i.* 4.)

Again; since the sides BD, DE of the triangle BDE are equal to CD, DE of the triangle CDE, and the base BE to the base CE, the angle BED is equal to the angle CED, or BEF to CEF. (*Euc. i.* 7.)

Also, since BE, EF in the triangle BEF are equal to CE, EF in the triangle CEF, and they contain equal angles, we have BF equal to FC.

Lastly; since in the triangles BAF, CAF, we have the sides BA, AF equal to the sides CA, AF, and the base BF to the base CF; we have the angles BAF, CAF also equal. They are also adjacent angles, and therefore BC is perpendicular to AF.

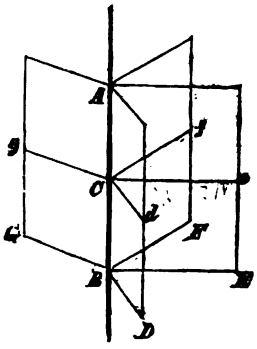
PROP. XXV.

Through any point in a straight line, innumerable lines can be drawn perpendicular to it; and all these perpendiculars will lie in the plane which is perpendicular to the line at that point.

(1.) Through the point C in the given line AB, innumerable straight lines can be drawn, all of which shall be perpendicular to AB.

Digitized by Google

For since the line AB admits of innumerable planes AD, AE, AF, AG, *etc.*, being drawn through it (*ax.* 3.), and that in each of these planes perpendiculars C*d*, C*e*, C*f*, C*g*, *etc.*, can be drawn to the line AB at the point C, one in each plane, the first part of the proposition is manifest.

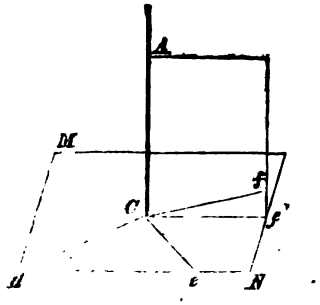


(2.) If it be denied that they are all in one plane, let MN be the plane which contains two of them. C*d*, C*e*; and let if possible another of the lines, C*f*, so drawn be above the plane, MN.

Draw the plane AC*f* cutting MN in C*f'*. Then (*prop.* 24) the angle AC*f'* is a right angle.

But by the assumption AC*f* is a right angle: and hence in the same plane A*f'* there are two right angles AC*f'*, AC*f* made with the same straight line, on the same side of it: which is impossible.

The line C*f* cannot therefore be out of the plane MN: or in other words the line C*f* is in the plane drawn through C*d*, C*e*. In the same way it is proved that all the specified lines are in the plane MN

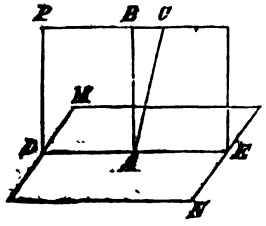


Prop. xxvi.

From the same point there can only be drawn one line perpendicular to a plane, whether that point be in the plane or without it.

(1.) Let A be a point *in* the plane MN: there can be only one line drawn through A perpendicular to MN.

For if there can be more, let AB, AC, be two lines perpendicular to MN; and draw through them a plane BCEA cutting MN in DE.



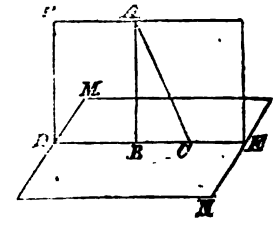
Then since AB is perpendicular to the plane MN and AE a line in it, the angle BAE is a right angle. In the same way CAE is a right angle (*prop.* 24.) Whence the lines AB, AC in the plane BAE are both perpendicular to the line AE in that plane: which is impossible. Wherefore in this case, only one line can be drawn from A perpendicular to MN.

(2.) Neither can two lines be drawn from A (*above* or *below* the plane MN) perpendicular to that plane.

Digitized by Google

For if there can be two, let them be AB, AC, and draw the plane PE through them, cutting MN in DBCE.

Then (*prop.* 24) the angles ABC, ACB, of the triangle ABC are both right angles; which is impossible (*Euc.* i., 17.)



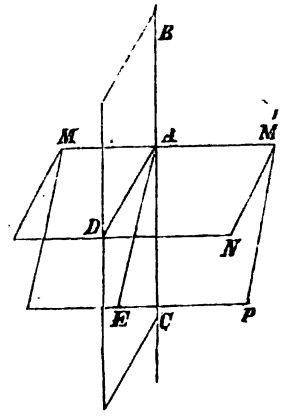
PROP. XXVII.

Through the same point there can be drawn only one plane perpendicular to a straight line, whether that point be in the line or without it.

(1.) Let the point A be *in* the line AC, then only one plane can be drawn through A perpendicular to BC.

For if there can be two, let them be MN, MP intersecting in MM′. Through BC draw any plane BD not passing through MM′, to cut MN, MP in the lines AD, AE.

Then since BC is perpendicular to both MN and MP, it is perpendicular to the lines AD, AE in them drawn through A (*prop.* 24); wherefore in the plane BD the lines AD, AE are both perpendicular to BC: which is impossible. Whence MN and MP cannot be both perpendicular to BC.

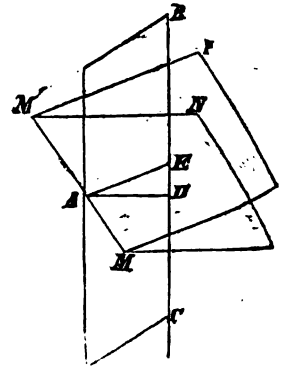


(2.) Let A be a point *without* the line BC: there can be drawn only one plane through A perpendicular to BC.

For, if possible, let there be two, viz., MN, MP. Through BC and A draw the plane BA cutting MN, MP in AD, AE.

Then EA is in the plane MP perpendicular to the line BC, it is perpendicular to BC. In the same way AD is perpendicular to BC; that is, two lines DA, EA in the same plane BA which meet in a point A are both perpendicular to the line BC: which is impossible.

More than one plane, therefore, cannot be drawn through the point A without the line BC perpendicular to BC.



Digitized by Google

SIMPSON'S SUBMERGED PROPELLER.

In our recent notice of this ingenious invention (*ante* p. 444) we described one only of the patentee's arrangements; and we now fulfil the promise we then made to describe another, which seems to us to possess a great advantage over the other.

Fig. 1.

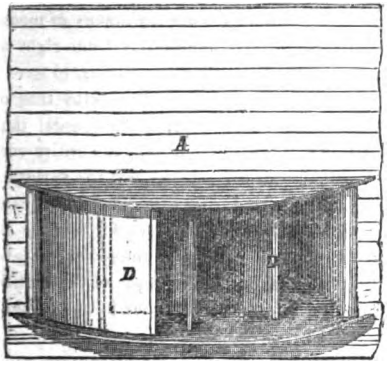
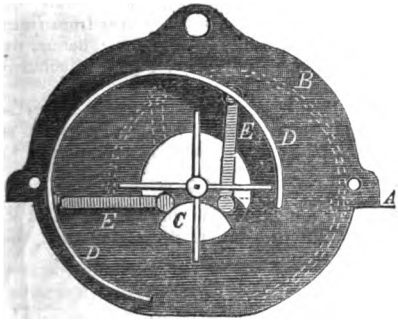


Fig. 2.



In the former arrangement provision is made for the backing of the vessel, by making a segment of the body of the wheel-case to open and shut by the action of the water, according as the vessel is moved forwards or backwards, and thereby to change from stern to stem, or *vice versâ*, the direction in which the water is ejected by the paddles. But by the plan we are now about to describe the body of the case is made in one entire piece, the whole of it is movable, and it is connected by two links to the top and bottom of the case, in such manner that by the pressure of the water forwards or backwards, the body of the case is immediately turned into the position most proper for driving the water in either direction. This is a great simplification of the first arrangement, and a very decided improvement. Fig. 1 of the annexed engravings is a plan of the propeller with this valuable modification, and fig. 2, an elevation of it. A, represents the side of the vessel; B, the recess which contains the propeller, C; DD, the body of the case; and E E, the connecting links.

We observe that Mr. Simpson has been making some more trials with his experimental vessel, the *Albion*, since that at which we had the pleasure to be present, and with similar success—the average speed attained, reaching generally to between 10 to 12 knots an hour. We cannot help thinking, however, that, with a vessel of better lines than the *Albion*—which, as we before observed, are excessively bad—a much higher speed than this ought to be realized. Even 10 or 12 miles an hour, however, is a great rate of speed for paddle-wheels to accomplish, with that entire absence of disturbance and vibration, for which this invention is pre-eminently remarkable. "Nothing assuredly," says the *Times*, "can be more beautiful than the noiseless and mysterious motion of Mr. Simpson's boat." We learn, from the same authority, that the diameter of the wheels in the *Albion* is only 24 inches; and that the wheels necessary for a boat of from 300 to 400 tons burthen, would not exceed 30 inches in diameter. If there be no error in these calculations, Mr. Simpson's propeller must prove a powerful competitor to both the common paddle-wheel and screw under a great many circumstances, but more especially in canals and narrow rivers, where not only injury to the banks, but the resistance of the banks to the progress of a vessel, has to be avoided.

Digitized by Google

MAIN AND BROWN'S TREATISE ON "THE INDICATOR AND DYNAMOMETER."*

The "Indicator," though it should be an inseparable companion to the steam-engine, is assuredly not so generally or so well understood as the engine itself; and it is not unfrequently neglected, solely from ignorance of its principle of action, and of the right mode of using it. The cause of this is, no doubt, the paucity of the information furnished respecting it in all the existing works on the steam-engine—the best of them not excepted. In *Bourne's Catechism*, (which we recently noticed with approbation, as being on the whole exceedingly satisfactory,) there is but a single paragraph devoted to the Indicator. The present treatise has been written with a view of remedying this prevailing defect, and by persons well qualified for the task. Mr. Main is the able Professor of Engineering at the Royal Naval College, Portsmouth, and Mr. Brown one of those valuable practical men whom a recent act of most judicious liberality on the part of the Admiralty, has promoted from the engine-room to the quarter-deck.

The treatise opens with the following clear and explicit statement of the ends fulfilled by the instrument:

1. It enables us to discover whether there are any defects in those parts of the machinery by which the steam is admitted to the piston; for instance, it indicates whether the slides are properly set, or leaky; whether the stops on the intermediate shaft are properly placed; whether the steam-ports are large enough; and, consequently, whether a different arrangement of the working part of the machinery would be advisable. In fact, in the hands of a skilful engineer, the Indicator is as the stethoscope of the physician, revealing the secret workings of the inner system, and detecting minute derangements in parts obscurely situated.

2. It discovers, at any instant of time, and under any given circumstances, when it may be desirable to apply it, what is the actual power of the engine.

A description then follows of the instrument as it is ordinarily constructed by Messrs. Maudslay and Field, illustrated by a very good set of engravings. It may be described briefly as consisting of a small hollow cylinder, which communicates with the working cylinder of the engine, and contains an easy-fitting piston, from the rod of which a pencil projects, which bears against a roll of paper divided into equal squares and wrapped round an adjacent cylinder, which is made, by means of clock-work, to revolve alternately from right to left and from left to right; that is, to have a motion exactly corresponding with that of the piston cross head. The pencil thus traces on the paper not only the entire vertical length of each stroke, but the variation of the pressure during every portion of each stroke. The following rules for reading off the various indications of the pencil may be taken as a favourable example of the sort of practical information afforded by the present treatise:

Bearing in mind that all *vertical ascending* motions are caused by an *increasing* pressure of the steam, and that the *descent* of the pencil is the consequence of the elasticity becoming diminished; and again, that as the traversing barrel revolves from left to right, the piston is descending;[1] while, on the contrary, as the pencil moves from right to left, the piston is ascending;[1] hence, we shall arrive at the following general conclusions:

1. If the motion of the pencil be vertically upwards, as at 1, the steam pressure is *increasing*, but the piston is *not* moving.

1 ↓

2. If the motion be downwards, as at 2, the steam pressure is *decreasing*, but the piston *not* moving.

2 †

3. If the line be placed horizontal, thus,

3 →,

the steam pressure *does not vary*, but the piston is *descending*.[1]

* The Indicator and Dynamometer, with their Practical Applications. By Thos. J. Main, M.A., Professor R. N. Coll., Portsmouth; and Thomas Brown, Engineer R. N. 43 pp. 8vo. With Plates and Woodcuts. Woodward, Portsea; and Hebert, London. 1847.

[1] This will be the case in one engine, but not necessarily so in another engine; and moreover, if the string be led in another direction the reverse will happen; but this the practical man can correct for himself according to circumstances, and substitute *ascending* for *descending*, and *vice versâ*.

Digitized by Google

4. If the line be thus,

the steam pressure *does not vary*, but the piston is *ascending*.[1]

5. If the line run as at 5, the steam pressure is *increasing*, and the piston is *descending*.[1]

6. If the line run as at 6, the pressure is *decreasing*, and the piston *descending*.[1]

7. If the line run as at 7, the pressure is *decreasing*, and the piston *ascending*.[1]

8. If the line run as at 8, the pressure is *increasing*, and the piston *ascending*.[1]

A number of examples are then given of the application of the instrument, and of the circumstances by which the accuracy of its indications is liable to be affected, illustrated mostly by actual diagrams obtained by Mr. Brown on board the Government experimental steamer *Bee*. One rather anomalous case is mentioned, which merits citation, on account of the important conclusions which it apparently involves:

How can the Indicator be employed for ascertaining the quantity of steam an engine uses?

Fix on any convenient part of the steam-line between that point where the steam is cut off and the opening is made to the condenser. Observe, by counting the vertical spaces, what proportion the portion of the stroke, as far as this point, bears to the whole length of the stroke. Notice also the pressure of the steam at this point. Then we shall have a certain fraction of the cylinder filled at each stroke with steam of a given pressure. If now the cubic contents of the cylinder be determined, and the number of times the cylinder is filled per minute, we shall have the quantity of steam of known pressure supplied to the engine per minute. Thus, suppose that in the *Bee* $\frac{8}{10}$ of the cylinder were filled with steam of 15 lbs. pressure; then, since the number of cubic inches in the cylinder twice filled is 15079·6, the number of revolutions being 34 at the time of experiment, the whole number of inches in a minute

$= 51252{\cdot}64$, $\therefore \frac{8}{10} \times 512526{\cdot}4 = 461273{\cdot}76$,

and the number of cubic inches of atmospheric steam in an hour

$= 461273{\cdot}76 \times 60 = 27676425{\cdot}60$.

But each inch of water is supposed to form 1711 cubic inches of steam at the atmospheric pressure, and therefore the number of cubic inches of water evaporated

$$= \frac{27676425{\cdot}6}{1711} = 16175;$$

and the number of gallons of water evaporated

$$= \frac{16175}{277} = 58 \text{ nearly.}$$

Now, if the theory be correct, this should be the quantity of water evaporated from the boiler, due allowance being made for condensation, &c., in the steam-pipe and passages. But this is far from being the case, for the number of gallons actually evaporated by the boiler was ascertained to be 108 gallons in the hour. We can do nothing more at present than state the discrepancy, and offer the following hypothesis to account for it. From the violence of the ebullition, the steam is in all likelihood not so dry as that on which careful experiments are made, as is frequently made manifest in boilers that "prime;" so that, even in good boilers, it is very possible for the steam to contain much more watery vapour than it would if it were not so rapidly consumed. If so, an inch of water would not under these circumstances form 1711 cubic inches of steam under the atmospheric pressure, and might perhaps form only one-half that quantity, which would be requisite to give the proper number of gallons of evaporated water. It remains to be seen by future experiments whether this be the fact; and if true, it will throw doubt on the tables of relative volumes of steam and water contained in most works on the steam-engine.

A few pages at the end of the work are devoted to the Dynamometer (hardly enough to justify the place which that instrument holds in the title,) on account of the use which has been recently made of it on board of screw vessels, to ascertain the exact amount of pressure given off by the screw-shaft, and consequently the amount of propelling force which the engine exerts.

It is as a treatise on the Indicator, however, that this work is to be chiefly regarded, and as such it is deserving of every praise. It seems to us admirably calculated not only to improve the engineers of our naval and mercantile services in the use of this instrument, but to make the employment of it more general as well on land as at sea. As no steam-engine should be without an Indi-

Digitized by Google

cator, so no Indicator should be unaccompanied by this guide to a true understanding of its properties and uses.

THE "PLUS AND MINUS PUZZLE."—AN AMICABLE ADJUSTMENT.

Sir,—I am not fond of obtruding my private history on the public, but your correspondent "Oseg's" illiberal estimate of my mathematical reputation, and his surprise at my folly, as he is pleased to term it, will, I think, justify my making you further acquainted with myself. I will, however, premise that the idea of turning my friend's argument against himself *did* occur to me at the time, but I rejected it at once as ungenerous; and as to the Cambridge equation not having "opened my eyes to the former," I can only say that I did open my eyes, and that very wide, at both of them.

In a letter to you in May last (p. 548,) I stated that it was my appointment as sub-engineer on the Glenmutchkin line that first called my attention to mathematics, and though, for my time of life, I made considerable progress, and knew, perhaps, as much of the subject as any of my brother-engineers, I must still confess to an "utter innocence" of the Differential Calculus. I am consequently unable thoroughly to appreciate "Oseg's" solution, though, as far as my lights go, it appears highly satisfactory, and may partially exonerate algebra from the blame I attached to it. The only differences with which I am acquainted—alas! but too well—are those whose only partial settlement on my part has led to my retirement from the turf.

"Quand celui qui parle n'entend rien, et celui qui écoute n'entend plus, c'est métaphysique." This maxim, which I picked up during my residence abroad, convinced me that it would be metaphysical, and consequently useless, for me and my friend (Mr. Cheetham, of the West Diddlesex Junction) to enter into the Differential Calculus; and I accordingly determined to take the advice so kindly sent me by Mr. Wilkinson.

I luckily found my friend at home, and commenced as prescribed. As soon, however, as I asserted that the equation $B(A-B)=0$ consisted of two independent factors, $A-2B=0$ and $B=0$, Mr. Cheetham stopped me short, and inquired how I knew that $B=0$, for it would be equally true to maintain that $B=97$, or any other number, as there was no doubt that $97\times 0=0$, and consequently there was no reason to suppose that B had departed from its original intention of representing half-a-sovereign. I perceived that he was in the right, and that nothing was to be got from Mr. Wilkinson's advice, however kindly intended.

As a last resource—

> "Quid non mortalia pectora cogis
> Auri sacra fames?"

I turned my friend's argument against himself, and assured him that I was now convinced that $A+B$ and $A-B$ were identical, and such being the case, I should much prefer his paying me the former. This was quite an unexpected turn—

> "'Twas his own genius gave the final blow,
> And help'd to plant the wound that laid him low;
> Keen were his pangs, but keener far to feel
> He nursed the pinion which impell'd the steel."

He soon recovered himself, however, and suggested, that as we were agreed upon the facts of the case, and there only existed a difference of opinion as to which of the sums he ought to pay, a middle course would be most creditable to both parties. I was struck with the good sense displayed in this remark, and on his paying me a further sum of ten shillings I gave him a receipt for the whole amount; and promising that he should hear no more of the matter, we parted mutually satisfied.

I must now apologize for taking up so much of your space and express my gratitude for your assistance, and remain

Yours, &c.,

J. K.

Nov. 23, 1847.

MONUMENT TO DAVY.

We notice, with pleasure, a tolerably widespread movement in the mining world, for the erection of a monument to the memory of the late Sir H. Davy. As a public benefactor, he richly merits such a memorial at our hands. In the ancient world, his statue would be adorned with garlands innumerable, in testimony of the innumerable lives which, by his genius and ingenuity, had been saved to the service of the state. His mortal footsteps are radiant with a light, which will burn on for the illumination and instruction of all the classes, and all the kindreds, of civilized mankind. His were

Digitized by Google

those peaceful conquests—his that silent heroism—which is seen in the additions it makes to public happiness, and in the enlargement it gives to public knowledge: knowledge, by which the foundations of virtue are strengthened, and the force and direction of the external elements so subjected to the government of a human hand. He was, in every sense, a man, whom the best nations, in their best times, would have been proud to enrol with their most renowned citizens, and to create for them permanent ensigns, and garlands personal. It is not our purpose to bring into review, at this moment, the vigour and the universality of his researches in chemical science; but, certainly, in the few years of his active life, he had done more for the advancement and consolidation of its leading principles than had been done since the days when Boyle and Cavendish were raised up as pillars of light in the temple of experimental chemistry. This illustrious man, moreover, was something beyond a professional chemist. He had the larger faculty, which enables its possessor to trace and comprehend the general frame of things, from the pebble which helps to floor our garden path up to the forked lightning. He saw, and dwelt upon, with the pleasure known only to a mind constituted like his, the almost infinite links of that golden chain which holds heaven and earth together. He was speculative up to the lights to which reason or analogy will allow a philosopher to soar; and chastened, nevertheless, in every ascending step he took by the lessons of experiment and demonstration. He is known to the mining population of these islands by his happy invention of the Safety Lamp—a simple, but most efficient contrivance, which has economised human life in the deep mephtic caverns of these kingdoms to an extent which few would apprehend, and fewer still can calculate. It is to commemorate the high endowments and beneficent life of this great man that the erection of a monumental column is now proposed. It is, in fact, heaping no flowers upon his grave, nor bestowing any gratuitous honours on his posterity and kindred: it is not from any such motive that the public will raise the trophy, or that succeeding generations will honour it. It is rather a slow, an insufficient payment of a debt we owe to a great public benefactor, and that we teach our children, by his perpetuated example, also to scorn delights and live laborious days—aiming at the acquisition of a character as pure, and of a reputation as wide, as that of the most favoured by Nature, and the most fortunate by circumstances.—*Mining Journal.*—Let there be a monument by all means; next to Newton, no man of science of this country ever deserved one more. But do not let any error, in point of fact, be mixed up with the grounds on which his memory is cherished. The Safety Lamp was, indeed, one of the greatest triumphs of his genius; but it is an historical untruth to say that it has "economized human life." On the contrary, the loss of life from explosions of fire-damp has been much greater *since* the introduction of the Davy than *before* it. And this is reasonably enough accounted for in two ways; first, by the neglect which the use of the Davy has induced of ventilation, which is a much surer means of preventing such accidents than any mode of lighting whatever: and, second, by its having enabled coal-owners to work mines so dangerously foul, that but for the Davy they could not, and would not, have been worked at all. The people benefited by it have been the coal-owners, but the poor coal-workers not at all. So largely, indeed, are the former its debtors, that were they alone to defray the cost of the proposed monument, they would be but performing a very ordinary act of gratitude. All this, however, detracts nothing from the merit of the invention itself. Employed in subordination to the interests of humanity, it was of a nature to confer incalculable good; and it is no fault of the inventor that it has been prostituted to the purposes of a base and ruthless cupidity.—ED. M. M.

ADCOCK'S SPRAY PUMP.—REPLY BY MR. ADCOCK TO CASSEL MORLAIS, AND OTHERS.

(Continued from page 501.)

"Cassel Morlais" (if he were at either of the public exhibitions of the spray pump—which I must be permitted to doubt) may, certainly have made—that is, entered into a book—memoranda, in the presence of several gentlemen, without one of them being cognizant of what he was writing. Of this I am quite satisfied, that not one of the gentlemen then present was made acquainted with, or gave sanction to, any memoranda so opposed to the facts before him. "Cassel Morlais" states, that the section of the pit is 240 ft.; the incoming quantity 30 cubic feet—which is equivalent to 187½ gallons per minute; and the height of the lift 20 ft. Whereas, the section of the pit, at the then water line, is 276 ft.; the incoming quantity of water per minute, 490 gallons; and the height of the lift, 54 ft. And, in addition to these, when the spray pump was first working, a quantity of water was drained from the adit level, which was 22 ft. long, and 4 ft. wide. Hence, admitting that

Digitized by Google

"Cassel Morlais" is not far wide of the truth in his assertion, that the body of water in the pit was sunk 2 ft. 6 in. in 8 minutes (for it was 2 ft. 3 in. in 7 minutes,) we shall find that, after making the above necessary corrections of his statements, the spray pump yielded an effect equal to 20-horse power, and not 4-horse power, as he has represented it to have been. It may be shown thus:

Quantity of water withdrawn from the pit,

$$\frac{276 \text{ ft.} \times 2\frac{1}{2} \text{ ft.} \times 6\frac{1}{2} \text{ galls.}}{8 \text{ minutes.}} = 547 \text{ galls.}$$

Quantity of water withdrawn from the adit,

$$\frac{22 \text{ ft.} \times 4 \text{ ft.} \times 2\frac{1}{2} \text{ ft.} \times 6\frac{1}{2} \text{ galls.}}{8 \text{ minutes.}} = 172 \text{ galls.}$$

Incoming quantity per minute..... 490 = 1209 gallons.

Making a total of 1209 gallons per minute, equal to 12,090 lbs., raised to the height of 55 ft.

$$\text{Hence, } \frac{12{,}090 \times 54 \text{ ft.}}{33{,}000} = 20 \text{ horse-power.}$$

But even these details do not give the exact relation between the power and effect; for the slits admit of being opened to a certain width only; and as at the time of the public experiments, the openings were at their utmost width, and maintained at such, the body of water flowing through them into the upcast pipe, lessened, as the height of the column of water in the pit decreased.

In order, therefore, to obtain a near approximation of the effect yielded by the spray pump, the calculations ought to be based on the first observation that was taken; in which the water was sunk in the pit 20 in., or a foot and two-thirds, in 4½ minutes. The calculations will then stand thus:

$$\text{From the pit:—} \frac{276 \text{ ft.} \times 1\frac{2}{3} \text{ ft.} \times 6\frac{1}{2} \text{ galls.}}{4\frac{1}{2} \text{ minutes.}} = 639 \text{ galls.}$$

$$\text{From the adit:—} \frac{22 \text{ ft.} \times 4 \text{ ft.} \times 1\frac{2}{3} \text{ ft.} \times 61 \text{ galls.}}{4\frac{1}{2} \text{ minutes.}} = 204 \text{ ,,}$$

Incoming quantity, per minute ..... 490 ,, = 1333 galls.

Exhibiting a total of 1333 galls., or 13,330 lbs., per minute, raised to the height of 54 ft.

$$\text{Hence, } \frac{13{,}330 \text{ lbs.} \times 54 \text{ ft.}}{33{,}000} = 22\text{-horse power.}$$

But those who were at Llanhiddel will recollect that, in addition to the above, a considerable quantity was drained from the adjoining pit, and other quantities fell back into the pit from the launder, and had to be re-raised. I will, however, allow the calculations to remain as they now are, and proceed with other parts of the inquiry.

1333 gallons of water per minute is a large quantity; and those who were present may recal to mind, that it was *quite as much as that*, by the following:—At the bottom of the receiver, in which the water, after it is raised, is collected, there is a pipe leading vertically downwards to the extent of 5 ft., to convey the water, when in a solid state, from the receiver to the launder. The bottom part of that pipe is 9½ in. diameter; and at the top, near its junction with the receiver, it expands, bell-mouthed, upwards, from 9½ in. to 11½ in.; yet the body of water was so great, that the pipe became choked, and the water in the receiver stood, *in a solid state*, 4 in. above its bell-mouth.

The vertical pipe, by a bend at the bottom, delivered the water into the launder; and it flowed thence into a zinc tub. In that tub was an orifice 12 in. diameter, through which the water was discharged into a channel, and thence, through a culvert, into the river. At the first part of the experiment, when the head of water had not subsided to any extent in the pit, that 12-inch discharging orifice was maintained constantly full, by the stream of water flowing through it—which is a convincing proof of the quantity; as it is well known to practical men that a 12-inch orifice, under a head of 1 foot above the centre of its aperture, or 6 in. above the top of it, will discharge 1440 gallons per minute. Again, the culvert 11½ in. wide, and 8½ in. deep, although with a rapid fall, was barely sufficient to carry the water away. These, therefore, are sufficiently corroborative of the fact.

I have now shown, by these investigations, that the blowing-cylinder, at Llanhiddel, has been worked to the same amount of pressure, per square inch, as I there employ, by a 26½-horse power steam-engine, and that the effect yielded by the spray pump was 22-horse power. I now state further, as an axiom,

Digitized by Google

that, had the same body of water been raised 11 ft. higher, the effect yielded would have been 26½-horse power; and, had the additional lift been 20 ft., it would have been 30-horse power.

$$\text{For, } \frac{(54+11)\times 13{,}330 \text{ lbs.}}{33{,}000 \text{ lbs.}} = 26\tfrac{1}{2}\text{-h. p.}$$

$$\text{And } \frac{(54+20)\times 13{,}330 \text{ lbs.}}{33{,}000 \text{ lbs.}} = 30\text{-h. p.}$$

And I confidently appeal to the gentlemen who were present, whether, when I removed the collecting cone, the water was not forced to a greater height! The fact is, the 12-inch pipes, now at the pit, are intended for the bottom of the mine, when it is sunk to the calculated depth of 200 or 260 yards, and thence, under certain definite laws, the pipes will expand upwards, to reduce the velocity of the effluent current. Had the pipes been proportioned for the experiment only, a greater body of water would have been delivered, and the relations of power and effect have been fulfilled; and where is there a pumping apparatus, under the ordinary modes of construction, may I ask, that would have yielded, power for power, so great an effect? In my apparatus, also, it must be considered there is, comparatively, no wear and tear.

HENRY ADCOCK.

ADCOCK'S SPRAY PUMP.—STATEMENT OF THE EXPERIMENTS MADE AT LLANHIDDEL COLLIERY. BY REGINALD J. BLEWITT, ESQ., M.P.

Being interested in a large coal-field, at Llanhiddel, extending over nearly 1,000 acres of mountain land, within the mineral district of Monmouthshire, I, about two years and a half ago, ascertained, by boring, that there was a vein of coal, 3 feet thick, lying under that property, at a depth of about 65 yards; and the presumption, from this discovery, being, that the other veins usually found below would also be in place, I ordered an engine, of great power—36-inch cylinder, 6 feet stroke, and three large boilers—in order to meet any casualties that might occur in sinking to the deepest veins. I had not then heard of the spray pump. The engine and necessary erections connected therewith were not completed until the summer of 1846, when I commenced sinking, in the usual manner, with a 12-inch pump, the working of which was so arranged, that it took three strokes of the engine to produce one of the pump. At the depth of about 25 yards, the incoming water had so much increased, that it could only be kept down by driving the engine 30 strokes per minute—making 10 strokes of the pump—a rate of speed which I considered imprudent and unsafe, and I had, therefore, determined to have a larger pump.

At this time I heard of Mr. Adcock's invention. The engineer I had employed to make my engine, &c., at Llanhiddel, was a Mr. Wm. Vincent Wennington, since deceased; he was a young man, of rising eminence in his business—a good mathematician and practical mechanic—of a prudent, and far from a *speculative* character; and he had, moreover, great practical knowledge and experience on the subject of compressed air—its power, properties, &c., having been largely engaged, and very successful, in the making of blast-engines and cylinders. In the month of August, 1846, I requested Mr. Wennington, who lived in Staffordshire, to see the spray pump, then in experimental operation near his residence, and to give me his opinion upon it professionally, and as a friend. On the 3rd Sept., 1846, Mr. Wennington wrote me thus:—"I have spent considerable time this week in investigating the merits of the blast-pump apparatus, and I am satisfied of the importance of the invention. With a few alterations in the details of the application, I think it can be made *an admirable thing in mining operations—equally efficient at* 1 *as* 1,000 *yards in depth.*" On the 12th Sept., 1846, Mr. Wennington said, in a letter to me—"I am more and more convinced of the importance of the invention: it will, in the first place, save half the expense of pump-trees, buckets, &c., besides which, there is no wear and tear at all. The principle is as unerring as any recognized law of nature can be, and the application of it is both simple and effective."

In consequence of Mr. Wennington's opinion, I invited Mr. Adcock to Llantarnam, and ultimately, with Mr. Wennington's full concurrence, and under his advice, I made arrangements for the application of the spray pump to my pit at Llanhiddel. After considerable delay, arising from Mr. Wennington's long illness. and subsequent untimely death, the apparatus, in its simple form, was completed. A trial was made before some of the principle iron-masters and coal-owners of the district, and the principle of the invention, was, as I considered, then clearly proved and admitted.

I had then to apply the invention to sinking. In sinking, it is, of course, necessary that the water at the bottom of the pit shall never exceed a few inches in depth. The spray pump requires for its action a certain altitude of water above the slit. The only way, therefore, in which the spray pump could be made available for sinking, was to

Digitized by Google

raise the water from the bottom of the pit by the common pump to a certain distance, and then to discharge it into a reservoir, in which the bend-pipes should be placed. This arrangement was carried out, and completely answered the purpose; but the sinkers have always been very much prejudiced against the invention; and as, in this form, it is more complicated, and attended, in so shallow a a pit, with little or no diminution of expense, I am not inclined to recommend, nor do I recommend, this adoption of the spray pump *for sinking*. With this exception, I am of opinion—as far as my humble opinion is entitled to any weight—that the spray pump, for the purposes of raising water from mines, has been, and may be, considered eminently successful. Nothing can be more simple than the apparatus required for a pit sunk to its intended depth. The following is a plain practical view of its operation:—The band-pipes communicating, in their downcast length, with the air reservoir; and, in the upcast, with an open tub of zinc, having a zinc cone suspended over the centre of the pit to collect the spray, are immersed in a sump at the bottom of the pit, having not less than a certain altitude of water.

The engine is set to work; the slit being gently and partially opened, a sort of struggle would at first seem to commence between the air and the water. In a few seconds, the water, dispersed into the most minute particles, is seen to rise, and, striking against the cone, to fall into the bottom of the receiver, from whence it flows away in a large stream—while the particles of air, emancipated, as it were, from the weight of water, rush together, and make their escape at the top of the receiver, left open for the purpose—a wider opening of the slit, and an increased action of the engine, produce such an upthrow of water in the form of gigantic drops, and such a whirlwind of air struggling for expansion, as it is not easy to conceive or describe.

Much has been said as to the great power of an engine; and it has been most untruly asserted, that nearly all of its power is necessarily used in raising water by the spray pump from a pit of 80 ft. deep. The engine, as I have before stated, was provided, *ex abundanti cautelâ*, to meet all casualties that might occur in the old and ordinary manner of sinking; and I believe it will not be denied by any experienced miner, that a surplusage of power, though, for a time, it may be attended with apparent loss, is often, in the end the truest economy. The large dimensions of the beam, cylinder, and other parts of my engine, of course, require a large supply of steam to keep it going; but a pressure of 15 or 16 lbs. to the inch on the boilers has, I am assured by my chief engineer, been found amply sufficient to keep down, by the double pump used for sinking, the incoming water—say, 500 to 600 gallons per minute—and what could be done by the full power of the engine is as yet unknown; as, when any great power has been applied, the existing pipes have proved inadequate to discharge the water raised; and when the cone, suspended over the top of the pit, has been removed, the water has been blown into the air to the height of 100 ft. and more.

What may be the limit of the powers of the spray pump, I have no means of forming an opinion; but I believe, with Mr. Wennington, that it may be made as effective at 1,000 yards as at one.

THE EMPLOYMENT OF HEAT AS A MOTIVE POWER.—NOTE ON "A. H.'S" PAPERS.

Sir,—There are several things in "A. H.'s" papers upon "The Employment of Heat as a Motive Power" which I should like to notice, but the subject is so new to me, that I shall content myself for the present by drawing his attention to one or two points only, in which I think he has erred a little. At page 404 he has the equation

$$C = nA\,(r' - r) + W$$

where (n) is the number of *chemical* atoms in the substance. Now if we consider the atom not as the unit of *chemical* power, but of *weight* or of *volume*, we shall by using the same kind of notation obtain

$$C_1 = n_1 A_1\,(r_1 - r_0) + W,$$
$$\text{or} \quad C_2 = n_2 A_2\,(\rho_1 - \rho) + W;$$

and in each of these three cases it is, *à priori*, as probable that

$$A_1\,(r_1 - r_0) = B_1\,(s_1 - s_0),$$
or that $A_2\,(\rho_1 - \rho) = B_2\,(\sigma_1 - \sigma)$,
as that $A\,(r' - r) = B\,(s' - s)$.

In fact, it seems to me to be a *petitio principii* to assume any one of them in preference to another.

It appears, indeed, "highly probable" when one substance is as much charged with heat as another, that the increment of linear distance between any two atoms of the one should be to that increment in the other, in the same ratio as that of their respective average resistances to separation; and it then follows clearly enough, even without the help of a visible formula, that the whole heat applied to each substance depends upon the number of atoms in each;—but there

Digitized by Google

is no reason why the atoms should be measured by their equality of chemical force any more than by their equality of weight or equality of volume, and therefore *before* experiment we have as much right to say, that the specific heats of equal weights of the two substances are inversely as their atomic weights, are equal, or are inversely as their specific gravities. It is experiment alone which shows us that the first case is the true one.

The other point I wish to notice is this; "A. H." does not allow for the tendency of the atoms to separate in the case of gases as he does for their resistance to separation in the case of solids and fluids. Should not the equations at p. 434 be

$$C = P.h - mA(r' - r)w + NR(p' - p),$$

and

$$C' = Pk - nB(s' - s)w' + NR(p' - p),$$

where (w) and (w') are the weights of equal volumes of the two gases, and are therefore as their specific gravities?—

$$\frac{\text{Specific heat (pressure constant)}}{\text{Specific heat (volume constant)}} = 1 + \frac{P.h. - mA(r' - r)}{NR(p' - p)}$$

using the same notation as in the previous examples?

I have a shrewd suspicion that I may be in the case of the blind attempting to teach the clear-sighted, but still I thought your correspondent limped a little—a thing very unusual with him—and so, following his invitation, I throw out the above hints to help us on the road.

I am, Sir, yours, &c.,

x^2.

Now, since by experiment $h = k$, it follows that C and C′ are not as "A. H." asserts, *equal*; but if we assume here, as before, that

$$A(r' - r) = B(s' - s),$$

then we obtain as the result that the specific heats of equal volumes of gases vary as

$$\text{A constant} - \frac{\text{Specific gravity of gas}}{\text{Atomic weight of do.}}$$

I have not at present at hand any table of the specific heats of gases other than an old one of Messrs. Delaroche and Berard, and they give for the specific heats of equal volumes the following:

Air	1.0000
Hydrogen	0.9033
Carbonic Acid	1.2583
Oxygen	0.9765
Azote	1.0000
Oxide of Azote	1.3503
Olefiant Gas	1.5530
Carbonic Oxide	1.0340

Should not also the equation page, 450, be

INQUIRIES AND ANSWERS TO INQUIRIES.

Permutation Lock. — Sir,—Many years ago I invented what I called a "Permutation Lock," and after various attempts to obtain a patent for it, I ultimately sent it to the Society of Arts, from which I received a silver medal. Since that time I have invented some very important improvements in both lock and key; which improvements render the lock utterly impregnable to any false instrument. I cannot at present enter further into the merits of the lock; but if any of your readers, in whom confidence may be placed, should be desirous of promoting my views, and to advance the means of securing the invention, a model will in due time be forwarded to your office. I am, Sir, yours, &c., ANGUS MACKINNON, 6, Hospital-street, Gorbals, Glasgow.

Painters' Brushes.—"Why do we never see any dark hairs in painters' brushes?"—QUERIST. Because white, or light-coloured hairs, are invariably of a much finer texture.

Aerostation.—The height to which Gay Lussac ascended was 23,000 ft. We do not believe that this has been ever exceeded.

Fan-blowers. — "A Founder and Ten Years' Subscriber" is referred to our Journal, No. 1242, where the subject is very fully treated. Good steel is preferable to gun-metal for the bearings.

Babbet's Anti-friction Metal.—The patent was taken out in the name of Mr. Newton on behalf of Babbet, who is a foreigner. The patent is dated May 15, 1843. The metal is composed of 50 parts of tin, 5 of antimony, and 1 of copper.

Spanners.—L. S. (Arundell) will find that he has been anticipated in his plan of a spanner by Mr. Fenn, of Newgate-street. The only difference is, that in Mr. Fenn's the screw is placed between two protecting cheeks instead of at one side.—See *Mech. Mag.* No. 1233.

"*Has a Rifle-ball but one Motion?*—Does it not both move forward and revolve in its course round its axis?"—ONE WHO HAS STUDIED UNDER WEISBACH AND ADMIRES HIM. We cannot better answer this question than by putting another in return, "Does a person in moving round a geometrical staircase do more than move in one spiral path?"

Digitized by Google

will be found an individual possessing great interest, the Curé Parramelle, the humble village priest, who has been sent for by the *Academie des Sciences*, in order to enlighten that respectable *corps* of *savans* concerning the extraordinary gift which he possesses of discovering hidden springs beneath the earth. It is curious to behold the touching simplicity of his manners, and his utter unconsciousness of the importance of the gift with which it has pleased heaven to bless him. It appears that this man's powers are most extraordinary, that *he has never once been deceived*, but told on the instant, without hesitation, the exact spot where water may be found. He is singular amongst those who have hitherto professed the science in his utter independence of the divining rod, which he has never needed. He describes the sensation he experiences when walking over a spring, to be that keen and pricking pain in the throat and nostrils, like that occasioned by the inhaling of phosphorus, or too strong a pinch of snuff.—*Paris correspondent of the Atlas.*

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Betts and George William Jacob, of Wharf-road, City-road, for improvements in the manufacture of capsules, and in the application of designs to certain descriptions of surfaces. November 30; six months.

William Eaton, of Camberwell, engineer, for improvements in machinery for twisting cotton or other fibrous substances. December 1; six months.

Gustavus Moenck, of Wellington-street, Strand, Doctor of Laws, for certain improvements in clocks and time-keepers. December 1; six months.

Thomas Chandler, of Stockton, Wilts, for improvements in machinery for applying liquid manure. December 1; six months.

Frederick William Mowbray, of Leicester, paper-dealer, for improvements in machinery for the manufacture of looped fabrics. December 1; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Designs.
Nov. 26	1270	Dunning, Cooper, & Co.,	Wolverhampton	Tumbler, or lever for locks.
27	1271	John Paterson	Wood-street, Cheapside	Slide for a brace.
,,	1272	Banjamin Lewis Valliamy	Pall Mall	Watch for travellers.
,,	1273	Henry Jones	Cobridge, Staffordshire	Ventilator.
29	1274	Joseph Stubbs	Thomas-street, Mill-wall	Lubricator.
30	1275	John Yates and Sons	Birmingham	Coffeepot and filterer.
,,	1276	Thomas Marsh	Charlotte-street, Portland-place,	Hand dibble.
Dec. 1	1277	John Mather	Beaufort-street, Chelsea	A three-way-cock.
,,	1278	W. M. W. Pigott	Birmingham	Button-back and shank.
,,	1279	William Newton	Chancery-lane	Adjustable horizon, or terminator, for a globe.

Advertisements.

Dredge's Improved Furnace and Registered Fire-Bar.

For Licences and Particulars apply to Mr. DREDGE, 10, Norfolk-street, Strand, London.

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs. T. Burnell and Co., 1, Great Winchester street, London.

Gutta Percha Company, Patentees,

Wharf-road, City-road, London.

October 1, 1847.

THE GUTTA PERCHA COMPANY, in requesting the attention of the Public to the accompanying Testimonials, have great pleasure in stating that the steadily increasing demand for the PATENT GUTTA PERCHA DRIVING BANDS justifies the utmost confidence that they are fully approved.

Their durability and strength, permanent contractility and uniformity of substance—their insusceptibility of injury from contact with Oils, Grease, Acids, Alkalies, or Water, and the facility with which the single joint required can be made in Bands of an indefinite length, render them superior for almost all working purposes, and decidedly economical.

Galoshes, Tubing of all sizes, Bougies, Catheters, and other SURGICAL INSTRUMENTS; MOULDINGS FOR PICTURE-FRAMES and other decorative purposes; WHIPS and THONGS, TENNIS, GOLF, and CRICKET BALLS, are in a forward

Digitized by Google

state of manufacture, and will be very shortly ready for sale.

All orders forwarded to the COMPANY'S WORKS, WHARF-ROAD, CITY-ROAD, will receive immediate attention.

Haslingden, September 4, 1847.

Dear Sir,—We have now been using the Gutta Percha Straps for the last eight months, and have great pleasure in saying they have answered our most sanguine expectations; and we may add, that some of our machines which required a 12-inch leather strap, and which almost daily required to be repaired, we have been turning the same with the Gutta Percha Straps 10 inches only for the above-named period, and now find them as good as the day they were first applied.

We remain, yours respectfully,
W. & R. TURNER.

To S. Statham, Esq., Gutta Percha Company.

Atlas Works, Manchester, Sept. 1, 1847.

Sir,—In reply to your inquiry as to the result of our experience with the Gutta Percha Straps, we have great pleasure in stating that the advantages they possess are so very manifest as to induce us to apply them in almost every instance where new straps are required.—We are, Sir, very respectfully,
SHARP, BROTHERS.

Samuel Statham, Esq., Gutta Percha Company.

Bridgewater Foundry, Patricroft, near Manchester, Sept. 3, 1847.

Sir,—In reply to your inquiry respecting how we like your Gutta Percha Machine Straps or Driving Belts, although we have not had quite so much experience in the above-named use of Gutta Percha as we hope to have, so far as we have employed it, it has given us general satisfaction. The beautifully straight and regular manner in which it runs on the pulleys, especially on our cone or speed pulleys, is a strong recommendation in its favour; and although we are inclined to think it does not take so fast a grip on the pulley as leather, yet there is ample hold for all general purposes. We shall continue to use it and to give it our best attention, so as to learn how to employ to best advantage the many excellent qualities it possesses over the ordinary leather belts.

NASMYTH, GASKELL, & CO.

S. Statham, Esq., Gutta Percha Works, London.

Manchester, 18th June, 1847.

Dear Sir,—We beg to inform you that we have now had the patent Gutta Percha Bands or Straps in use for more than six months. For tube frames we consider them very much superior to anything we have tried before. They also do very well as open straps for mules, throstles, looms, &c.

We are, Sir, yours respectfully,
THOS. DODGSHON & NEPHEWS.

Mr. Samuel Statham, Gutta Percha Company.

Wellington Mills, Stockport, 4th September, 1847.

Gentlemen,—We have much pleasure in bearing our testimony to the valuable qualities of the Gutta Percha for driving bands. We have found it answer exceedingly well in most cases where we have tried it, and we think it has only to be made known to ensure its very general use.

We are, Gentlemen, yours obediently,
HOLE, LINGARD, & CRUTTENDEN.

To the Gutta Percha Company, City-road, London.

Tottington Hall, near Bury, Lancashire, September 3, 1847.

Dear Sir,—Your letter of the 31st August is to hand, and in answer respecting the use of your Gutta Percha Bands, I cannot give you a better proof of our approval of them in preference to leather straps, than having given an order for another to your partner, yesterday, to be in readiness in case of accident. They are decidedly preferable to the old straps; and we can recommend them with the greatest confidence to any person for Driving Straps.

For HALL & GORTON, THOMAS GORTON.

S. Statham, Esq., Gutta Percha Company.

Brewery, 16th September, 1847.

Gentlemen,—We have much pleasure in repeating our testimony to the very great improvement effected by the use of Machinery Bands made of your material instead of leather: the stoppage of parts of our works, through the failing of the leather straps, used to be of daily occurrence, causing great inconvenience and expense. With this annoyance we are now never troubled, and are assured by our superintendent that the advantage of using your material is surprising, as regards economy and saving of trouble. We confidently recommend it to machinists and factories for general adoption.

TRUMAN, HANBURY, BUXTON, & CO.

To the Gutta Percha Company.

Patent Gutta Percha Soles for Boots and Shoes.

The capabilities of the GUTTA PERCHA SOLES FOR BOOTS AND SHOES having been extensively and satisfactorily tested, we can unhesitatingly recommend the material prepared for the purpose, its merit having been acknowledged by all who have worn it. Indeed, experience has proved that Gutta Percha Soles wear twice as long as leather, with great additional personal comfort, and they remain perfectly impervious to wet until quite worn through.

23, Southampton Row, 1st Sept., 1847.

Gentlemen,—I write to thank you for allowing me to use the new PATENT GUTTA PERCHA SOLES. I felt annoyed at not being allowed to use them from the time I had first worn them, namely, from last October, but am not sorry now, because I can speak confidently of their advantages over leather soles. I made the first pair last October, and wore them eight months before I wore the soles through. I had them heeled six times, and one pair of extra fronts I put to the same soles. *I only kept the one pair in wear to see how long they would last.* I will never wear another leather sole so long as I can get GUTTA PERCHA SOLES, and I walk from 12 to 20 miles a day.

C. WRIGHT, Boot and Shoe-maker.

To the Gutta Percha Company.

9, Gloucester Row, Hoxton, 5th July, 1847.

Sir,—I beg to thank you for the boots with GUTTA PERCHA SOLES which I had from you on the first of the year. I have had them in constant use for nearly five months, the greater portion of that time being the most inclement period of the year; and from my occupation as a general post letter-carrier, you may be sure that they have had more than a common fair trial, and the Gutta Percha seems now as firm and as little worn as on the first day. W. HUTTON, G. P. O. Letter Carrier.

To E. Granville, Esq., Gutta Percha Works.

28, St. John-street, August 25th, 1847.

Gentlemen,—It gives me great pleasure to acquaint you that the Gutta Percha Soles I had from your Works have answered the purpose admirably, as I can fully testify, having had them in wear six months, during the winter, in Smithfield-market, and have not been subjected to the annoyance of wet feet, as is often the case with leather soles, and, in my opinion, they wear three times as long.

H. I. TARLING.

To the Gutta Percha Company.

N.B.—The above Soles, which are not worn out, may be seen at the Gutta Percha Company's works.

No. 3, Union place, New-road,

Dear Sir,

I have worn the Gutta Percha Soles for nearly a year, with much satisfaction and comfort: in wet and cold weather they keep the feet perfectly dry and warm—are pleasant to wear, and I have found them more durable than leather.

I am, Dear Sir, yours faithfully,
W. GORTON.

To the Secretary of the Gutta Percha Company.

Digitized by Google

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

Fall of the Barometer.—G. (Rothsay) states, that previous to the last great storm in the west of Scotland, his barometer fell 8½ inches. There must be something the matter with his barometer. The greatest fall ever before recorded did not amount to 4 inches.

What to Eat, Drink, and Avoid.

Sound digestion! What a boon; but what a rarity. All the wealth in the world cannot buy it, and yet how simple it is to secure it. Dreamless nights!—How refreshing is a good night's rest, and how few obtain it! How fearful is illness, and who have we to blame for it but ourselves! Physic is one evil to cure another; but caution keeps off more fire than water quenches. Reader, if you value the desiderata of good health in the day, and tranquil repose at nights, together with mental serenity at all times, or should lack firmness of nerve or purpose, or suffer from the sorrows of an afflicted body, seek how to obtain the former, and remove the latter, in DR. CULVERWELL'S little Memoirs, called "HOW TO LIVE; or, WHAT TO EAT, DRINK, and AVOID;" and its Companion—"HOW to be HAPPY" (the price is but 1s. each if by post, 1s. 6d. in stamps.) They recommend no nostrum, pill, or balm, but render every possessor master or mistress of his or her own case. They tell home truths, and detail facts that may astound, but which are worthy of recognition, and they furthermore unmystify the laws of life, health, and happiness; that how to live happily and contentedly, is rendered clear and open to the humblest intelligence. To be had of Sherwood, 23, Paternoster-row; Carvalho, 147, Fleet-street; Mann, 39, Cornhill; Nelson, 457, West Strand, and all booksellers; or direct from the Author, 10, Argyll-place, Regent street; who can be personally conferred with daily till four, and in the evening till nine.

Smithfield Club Prize Cattle-Show, 1847.

THE Annual Exhibition of Prize Cattle, Seeds, Roots, Implements, &c., 8th, 9th, 10th, and 11th December, at the Horse Bazaar, King-street, Portman-square. Ladies are enabled to view this National Exhibition with perfect comfort; and, for the better accommodation of visitors, a large saloon for refreshments is this year added. Open from Daylight till Nine in the Evening.

Admittance—One Shilling.

Patent Metals for Bearings.

ENGINEERS, and all Manufacturers in Brass, &c., &c., are respectfully invited to test the quality of these new alloys, which have already received the sanction of eminent engineers and parties connected with public works. One sort for bearings and engineering purposes generally, will be found superior in quality, and cheaper than the metals now in use. Other sorts will be found of a better colour, a more brilliant surface, and bearing a higher polish than any ordinary brass. Messrs. Mears will be happy to send any quantity as samples, or to make any castings from patterns sent to them.

Patent Bells.

MESSRS. MEARS beg to call the attention of the Trade and the Public generally to these articles, which they are now prepared to supply in any quantity and variety. The composition is of a new metal, called the Union Metal, and the bells are of very beautiful tone, and cheaper than those made of the ordinary bell metal. Orders received at the Bell Foundry, Whitechapel, for house, cattle, and other bells.

CONTENTS OF THIS NUMBER.

Description of Law's Patent Improvement in Yarns, and Yarn-spinning Machinery.—(*with engravings*) 539
On Railway Train Signals. By Owen Rowland, Esq. 543
The Employment of Heat as a Motive Power. Reply by A. H. to x^2 543
On Mr. Cubitt's Experiments on the Utility of Tensile Rods as applied to Girders. By William Dredge, Esq., C.E. 544
Telegraph Organs. By Hyde Clark, Esq. 545
On a Simple Investigation of the Experimental Theorem. By Professor Young 546
On the Reduction of a Function of the Second Degree, and of Three Variables. By James Cockle, Esq., M.A. 547
On Steam Boiler Explosions. By Mr. William Hopkinson 547
On Franklin's Oil and Water Experiment. By Mr. G. Johnson 548
Remarks on Locomotive Engine Blast Pipes 548
Light and Heat.—Experiments by Professor Henry 549
Traveller's Coffee Pot. By John Macgregor, Esq.—(*with engravings*) 550
Sharp's Horological Tell-tale—(*with engravings*) 551
Improvements in the Manufacture of Malleable Iron. By R. J. Blewitt, Esq., M.P. 552
The Spray Pump.—Rejoinder by Cassel Morlais 552
Experiments on Boiler Scales 554
The New "Pont aux Doubles" at Paris 555
Calendar of Specifications—(*continued*) 556
Inquiries and Answers to Inquiries 557
Notes and Notices 558
Weekly List of New English Patents 560
Weekly List of Articles of Utility Registered 562
Advertisements 560

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

Digitized by Google

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1270.] SATURDAY, DECEMBER 11. [Price 3*d.*, Stamped, 4*d.*

Edited by J. C. Robertson, 166 Fleet-street.

BROOMAN'S PATENT IMPROVEMENTS IN SCOURING AND BLEACHING.

Fig. 1.

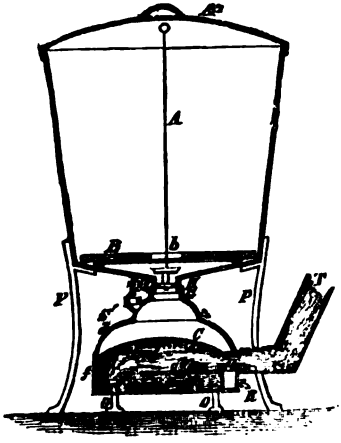


Fig. 2.

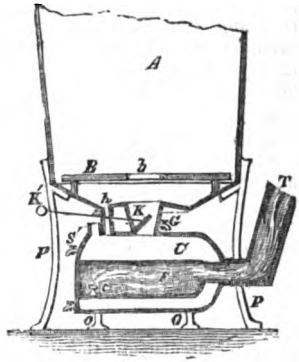


Fig. 5.

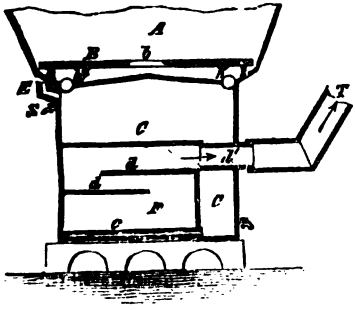


Fig. 3.

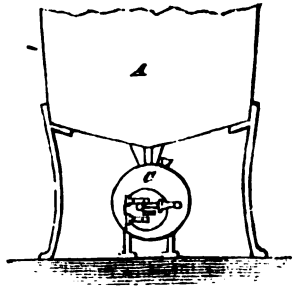


Fig. 6.

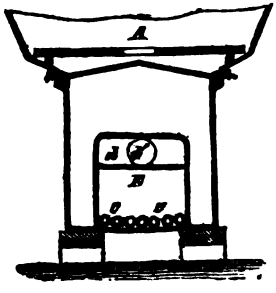
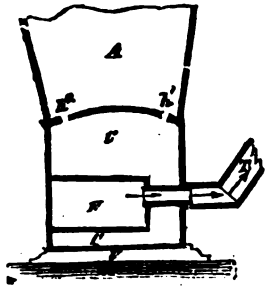


Fig. 4.



Digitized by Google

POOLEY'S PATENT IMPROVEMENTS IN WEIGHING MACHINES.

[Patent dated June 16, 1847; Specification enrolled December 16, 1847.]

The improvements embraced in this patent are numerous and important. The object of the patentee may be said to have been twofold; *first*, to produce a greater exactness of performance in weighing machines, more especially those of the larger class, commonly called weighbridges; and, *second*, to give them a more extended application to purposes of trade and business. The improvement in performance is effected chiefly in three ways; 1st, by a mode of relieving the knife-edge bearings from all strain or wear, except when the machine is in actual use for weighing purposes; 2nd, by placing out of sight and touch (except by the person in charge) the adjusting parts of the machine; and 3rd, by protecting, in the case of weighbridges, the pits formed for their reception from the intrusion of wet and dirt. The new applications consist; 1st, of a combination of these improved weighbridges with the turn-tables on railways; 2nd, the adaptation of platform weighing machines to the adjustment of the springs of locomotive engines; and, 3rd, the combination in one machine of the means both of hoisting and weighing.

A machine of the weighbridge kind, embodying the first branch of these improvements, is represented in the accompanying figures, 1 to 15 inclusive. The following description of the details we extract from the patentee's specification:

Fig. 1, of the accompanying drawings represents a top plan, with the table or platform removed, in order to show the construction of the levers and other parts beneath. Fig. 3, is a side elevation of the same, and fig. 4, a transverse elevation. (In the two last views several of the parts are shown in section.) AA, are two foundation plates of cast-iron securely bolted to a level bed of stone, brick, or timber. (A top view of one of these foundation-plates is given separately in fig. 2.) BB, B^1B^1 are four props or fulcra, which rest loosely in slots or sockets, cc, made for them in the foundation plates, and have a small extent of lateral action to admit of their accommodating themselves to the movements of the principal levers. These fulcra have steel faces on their upper ends, which in their cross section are of a curved form, upon which faces the knife-edges, FF, of the levers rest. D^1 and D^2 are the two principal levers of the machine; the larger one, D^1, stretches in a diagonal direction from its fulcra, BB, to the point E, where it is connected with the steelyard (figs. 1 and 4.) FF, are the knife-edges by which this lever rests on the fulcra, BB. The shorter lever, D^2, rests by knife-edges, FF, on the fulcra, B^1B^1; at its smaller end it terminates in a knife-edge (seen in section, fig. 3,) which rests within a coupling ring, L, by which ring it is connected to the principal lever, D^1, at a projecting point cast thereon. GGGG, are four verges or knife-edge supports, which are inserted in the top surfaces of the levers, D^1D^2, and support the table or platform of the machine. M, is a bar of timber, cut to the form shown, and bolted to the under side of the long lever, D^1, for the purpose of correcting the vibration which would otherwise be caused in the machine by the drawing of a carriage on to the platform, and which is at present a source of much inaccuracy in weighing machines. N, (figs. 3 and 4,) are two strong beams of timber (or made of iron and timber combined, if preferred) for the purpose of sustaining the weight of the platform and load. To the under side of these beams are bolted four bearing pieces, OOOO, of cast iron, from which project downwards four studs, *qqqq*, with curved steel faces, which rest on the knife-edge verges, G. These bearing pieces are prolonged outwards beyond the studs to the extremities of the beams. PP, are cast-iron receiving props, which are firmly bolted, or otherwise secured to the foundation plates, AA, and come immediately under the prolonged portions of the bearing pieces, OO. When the machine is in a dormant or quiescent state, that is to say, ungeared, or not in a weighing state, the platform rests on these props. A plan of these props is given separately in fig. 5, a side view in fig. 6, and a front view in fig. 7. The balance or steelyard part of the machine, with the framework to which it is attached, forms the upper portion of the side elevation, (fig. 3;) Q, is the steelyard, which is constructed and suspended as afterwards described. R, the movable poise, with its handle, which indicates the fractional parts of a ton or hundred weight, as the case may be. S, the counterpoise, by which the levers, platform, and other parts of the machine are balanced, and upon the plate of which weights representing tons or hundred weights, as the case may be, are placed in weighing (except in those machines which have a supplementary steelyard, as hereafter described.) The steelyard is shown, detached

Digitized by Google

from its frame, and on an enlarged scale, in figs. 8 to 13, both inclusive; fig. 8 being a side elevation of it; fig. 9, a longitudinal vertical section; fig. 10, a horizontal section; fig. 11, a top view of it; and figs. 12 and 13, transverse sections on the lines *ab* and *cd*. It will be seen, from an inspection of these figures, that the body of the steel-yard is hollow, and has concealed within it an adjusting weight or bar, T, which is

Fig. 4.

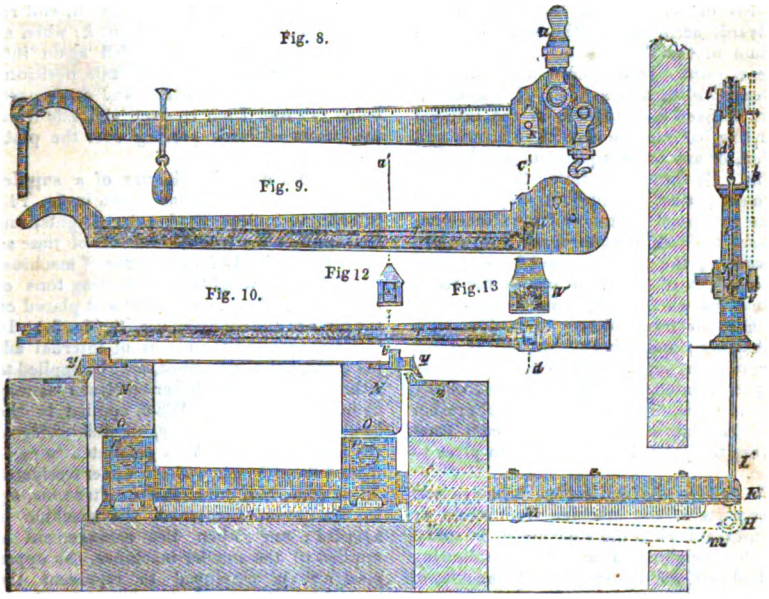
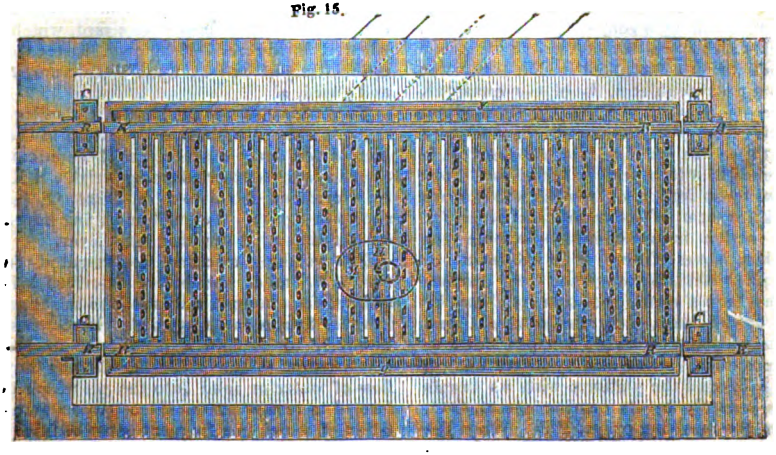


Fig. 11.

Fig. 15.



movable to and fro in its recess by means of a screwed rod, U^1. The screwed rod, U^1, carries at one end, V, a pinion with diagonal teeth, into which gears an endless screw or worm, W, the axis of which is fixed at right angles to the screwed rod, and, pass-

Digitized by Google

ing through the sides of the steelyard, is filed off flush therewith. A hole, K, is made in each side of the steelyard, opposite to each end of the axis, by inserting a key into which the worm, W, may be turned round, and the adjusting weight, T, made by means of the screwed rod, U, either to advance towards or recede from the point of the steelyard, according as the state of equilibrium of the machine may from time to time require. If desired, the key may be dispensed with, and a head, with a milled edge, be fixed to the worm, or the internal adjusting bar may be moved by a rack and pinion, or any other equivalent mechanical means. By thus constructing the steelyard, the most perfect equilibrium may be at all times preserved in the weighing machine, without any risk of disturbance from external causes; the adjusting weight is placed not only out of sight, but out of the reach of persons who might, from curiosity, or mischief, or fraud, desire to meddle with the balance; and it is capable, at the same time, of being regulated with perfect ease by the person in charge. It is, besides, wholly free from liability to accidental alteration which in other machines often occurs from moving the portable machines from place to place.

To relieve the knife-edge bearings and other parts of the machine from strain or wear, except when the machine is in actual use for weighing, I adopt the following method:—Over the suspending shackle, *a*, (figs. 3 and 8) of the steelyard, is placed a pulley, *b*, (fig. 3,) which turns freely on its axis, *c*. To this suspending shackle is riveted the first link of a chain, *d d*, which passes over the pulley and is connected at its other end by a rod, *e*, to another chain, *f*, which is carried round a quadrant, *g*, and terminates in a screw-bolt which is inserted into the extreme end, *h*, of the quadrant, where it is secured by a nut, the screwed end serving to give the exact regulation of length to the chain. The quadrant, *g*, is attached to a long and powerful hand-lever of wrought iron, *i*, or in other words forms the short arm of the compound lever, *i g*. The action is as follows:—Suppose the machine is out of gear, or in a dormant or quiescent state, the long hand lever assumes in that case a vertical position, as shown by the dotted lines, *k k*, the steelyard and main weighing levers are dropped down to the positions, (shown also by dotted lines, *l*, in fig. 3,) and the platform with its beams rests securely by its bearing pieces, O O, upon the receiving props, P P. When the machine is required to be put into a weighing state, the long hand lever, *i*, is drawn down from the vertical to the horizontal position, that is from *k*, *k*, *i*, (fig. 3,) and made fast in the strong catch or staple, *n*, which is bolted to the pillar, *p*. The effect of this is to raise the steelyard, the weighing levers, and the platform, to the precise points for weighing.

When the weight is ascertained, the hand-lever, *i*, is released from its catch, and returned to the vertical position, *k*; when all the parts of the machine fall again into their former quiescent and safe position; all the knife-edge bearings and other parts being released from contact, and safe from the effects of loads passing over the platform.

In some cases I make use of a supplementary steelyard, X (as shown in fig. 14,) in order to indicate the heavier weights, and thus obviate the trouble and loss of time so often complained of in the case of machines which require weights, representing tons or hundred weights, to be lifted and placed on the plate of the counterpoise, S, (fig. 3.) In this arrangement the means of internal adjustment, before described, may be applied to either the upper or lower steelyard as may be most convenient. When applied to the larger weighing machines, or weighbridges, the lower steelyard, Y, is graduated to parts from 1 lb. to 5 cwt., and the upper steelyard, X, to tons, half tons, and quarter tons, up to the power for which the machine is adapted; and when this arrangement is applied to the smaller machines, the upper steelyard is employed to represent the hundredweights, and the lower steelyard pounds or ounces.

When the relieving apparatus is to be fixed to machines having the supplementary steelyard, (fig. 14,) the compound leverage is connected to the lower steelyard, which, when it is lowered out of gear, leaves the upper steelyard at rest upon its fulcrum, *t*, and guard, *s*.

To render also the working of the relieving apparatus a still easier operation in the case of very large weighbridges, I sometimes attach a large counterbalancing weight, X X, by a common chain to a quadrant, Q, (as shown in fig. 14,) the quadrant being keyed on the axis, *z*, of the long hand lever.

The weighing machine, (represented in figs. 1, 3, and 4, and before described,) is adapted for use upon railways, and is shown in these figures as so applied. It remains, however, to explain a peculiarity in the construction of the platform, whereby any flow of water or mud into the pit which is formed to receive the machine (the accumulation of which is a frequent cause of injury to such machines, and of inaccuracy in their indications) is wholly prevented, and which improvement is equally applicable to the

Digitized by Google

platforms of weighbridges or turntables, wherever placed.

With this view I make the kirbs, *z z*, of cast iron, and in the form shown in the section in figs. 3 and 4, the inner edges being turned up angularly as a flanch. Over the top of the kirb so formed, the moulded edge, *y*, of the platform is brought as seen in section, in fig. 4. It is obvious that this shape of kirb and platform will turn off any water that may fall upon them, whilst the improved relieving apparatus, before described, by raising the platform from its quiescent position, will free the edge of the platform from contact with pebbles, or other matters which might otherwise affect the accuracy of the results. A plan of the platform as fixed, is given separately in fig. 15; R R, are the rails; C C, chairs; P, the platform; and M H is a man-hole, to give access to the pit, for the purpose of cleaning or repair.

I have described my improved steelyard and relieving apparatus as connected with a weighbridge, with rectangular platform, and as adapted to a railway, but I wish it to be understood that I do not confine myself to that particular shape or application, but that

Fig. 17.

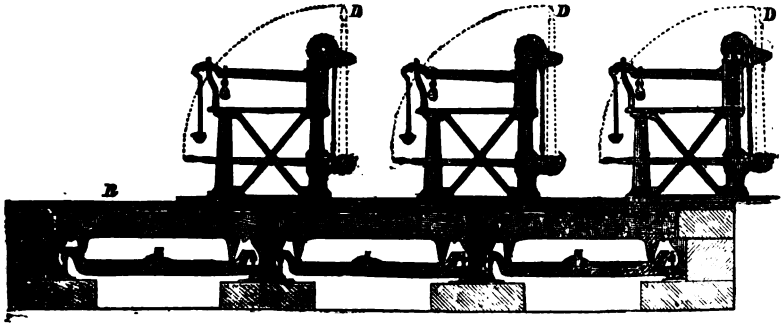
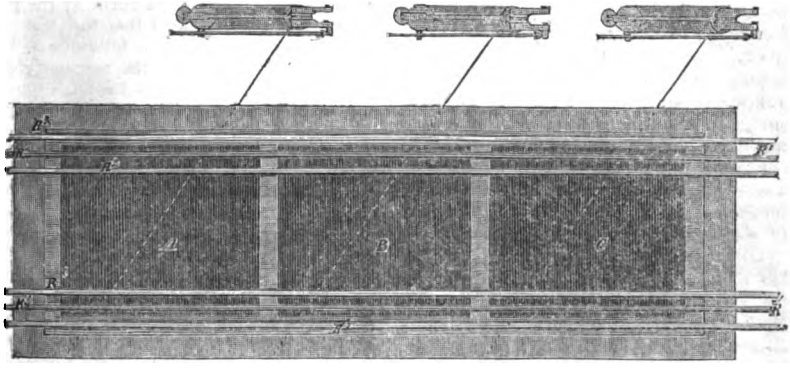


Fig. 16.



the platform may be circular, hexagonal, or of any other convenient shape, and the machine be adapted as well to common roads as railways.

The enclosing of the adjusting weight or bar in the body of the steelyard is an adroit and ingenious contrivance; the new form given to the kirbs of the platform, is also a most obvious and useful improvement, but the most striking feature of all is, undoubtedly, the knife-edge relieving apparatus. Many attempts have been before made to protect the knife-edges when out of work, but none which could boast of such decided success as this. The mode hitherto commonly employed for this purpose has been to place underneath the platform,

Digitized by Google

a system of machinery composed of cams or eccentric wheels, pinions, levers, &c., by which the dead weight of the machine might be raised off the knife-edges; but such machinery, besides being complicated and liable to derangement, requires both considerable time and labour in working. Mr. Pooley's machine is wholly free from these objections. He avails himself, as the reader will perceive, of the power of the principal weighing lever, D^1, for the purpose of effecting the desired relief; combined certainly with other relieving levers, but which contribute only in a very inferior degree to the end in view. We make no doubt, that by this means the machine may be raised with nearly equal ease and celerity into a weighing position, whether it is empty or loaded.

We are not unmindful, that in the class of weighing machines made according to Mr. Fairbank's patent, the knife-edges are relieved by means of a single lever, which is placed above the head of the machine, and lowers the platform down to a stationary bed, or bearing; but this is an arrangement which is applicable only to the smaller description of weighing machines, and is wholly unsuited to large machines of the weighbridge class.

The reader will, of course, understand, that though the patentee has contented himself with describing how his improvements are applied to the weighbridge class of machines, they are equally applicable to machines of all sizes; to such, for example, as are used in warehouses, wharfs, and shops, and whether they are stationary or moveable; making always such modifications in point of dimensions and arrangement as differences of circumstances may obviously require.

Of the *new applications*, the 1st has been already disposed of, by the preceding description—namely, the combination of these improved weighing machines with the turntables on railways. The details of their application to the adjustment of the springs of locomotive engines, which forms the 2nd application, are represented in figs. 16 and 17, and thus described.

Fig. 16, is a plan of a set of weighing tables or platforms, A, B, C, with a principal line or pair of rails, $R^1 R^1$, passing over them, and two other parallel lines or pairs of rails $R^2 R^2$, and $R^3 R^3$. Each of these tables or platforms is connected with a steelyard, of the improved construction before described, with its frame and relieving levers, (as shown in the longitudinal section, fig. 17.) Now, supposing these tables to be in a dormant or quiescent state,—that is to say, with the long hand-levers in the vertical position indicated by the dotted lines, D D D, and the platforms with their beams resting by their bearings, O O, on the props, P P P P; then let a locomotive engine be brought upon the machine along the rails, R R, till each pair of its wheels rests upon one of the tables; when the engine is so placed, let the long hand levers, D D D, be brought down to the horizontal position, which will bring all the parts of the machine into a weighing state. The steelyards will then indicate, first, the gross weight of the engine, and second, the weight imposed on the rails by the leading, the driving, and the following wheels, respectively; and also, of course, the state of the springs by which the engine-frame is supported upon the axles: should any of the pairs of wheels appear to be unduly loaded, the bolts by which the springs are made tight or slack may be screwed or unscrewed, until in the judgment of the engineer the driving wheels have their proper impact, and each of the other pairs of wheels bears a suitable proportion thereto. But it may, and does often, occur that one of the springs of a pair of wheels may not be properly adjusted, although the entire weight indicated as borne by the pair of wheels is accurate; I therefore test the wheels separately, in manner following:—The engine is first drawn on the machine along the rails, $R^2 R^2$, by which the three wheels on one side only of the engine are brought upon the tables, the wheels of the opposite side being upon the permanent way. The indicated weight of each of these three wheels is noted, after which the engine is drawn off to convenient points or sections, and again brought upon the tables along the rails, $R^3 R^3$, whereby the weight of the wheels on the opposite side of the engine is ascertained in like manner. The two sets of results are then compared, and any disparity corrected by screwing or unscrewing the springs, until a perfect adjustment is effected.

A very simple way this is, of correcting a very frequent source of irregularity in the action of locomotive engines, and one which is we apprehend but too generally overlooked. Engines would never jump so often as they do were they as equally balanced as they ought to be.

The combined machine and weighing

Digitized by Google

machine (3rd new application) is represented in fig. 17 to 22 inclusive:

Fig. 18 is a side elevation, partly in section, and fig. 19 a top plan of a weighing crane adapted to the above purposes. In its general form it resembles a crane of an ordinary kind; and the wheel and barrel, pinion-shafts, and other hoisting-parts, may be of any approved construction, according to the power required in the crane, or to the weight which it is intended to lift.

Fig. 20.

Fig. 21.

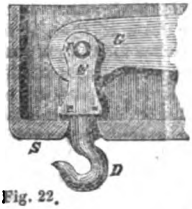


Fig. 22.

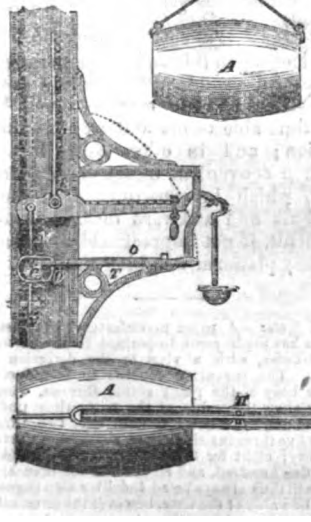


Fig. 17.

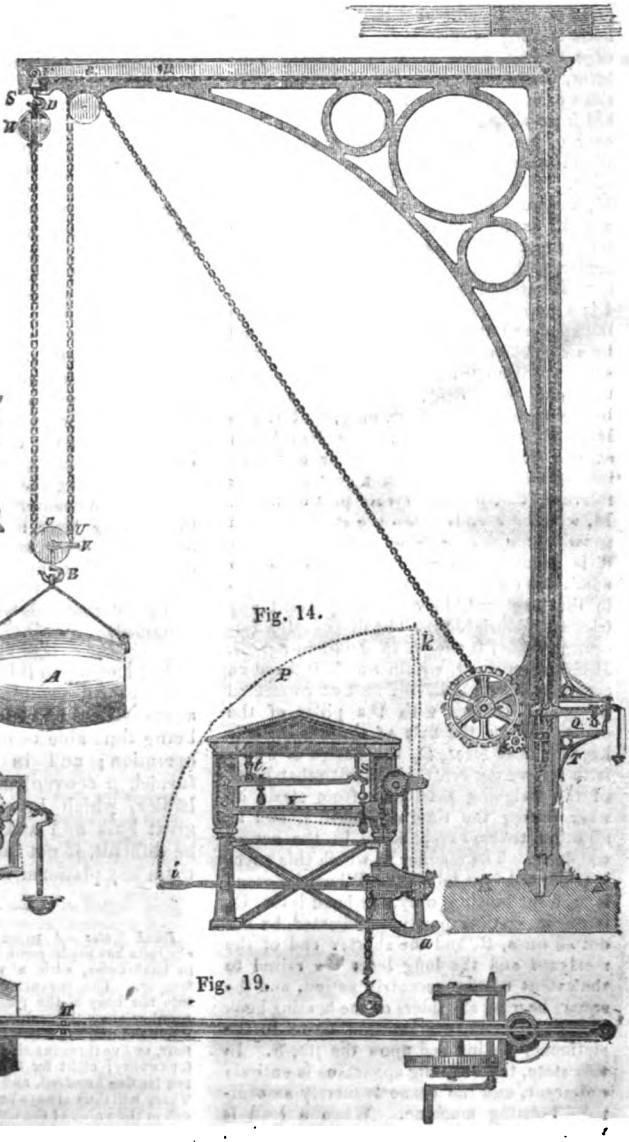
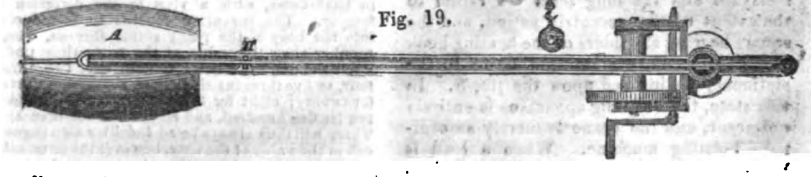


Fig. 14.

Fig. 19.



A, represents a load hanging to the crane by a hook, B, and live pulley, C. Round

Digitized by Google

this pulley, C, the chain passes, and has its last link attached to the peculiarly formed bearing hook, D, (which is shown separately in an enlarged scale in figs. 20 and 21—fig. 20 being a front, and fig. 21 a side view.) The upper portion, E, forms a double shackle, the holes in which have their surfaces of hardened and polished steel. The hook is hung by these holes upon the knife-edge centres, F, of the long lever, G. This lever, G, is shown as placed between the sides of a double jib, by which sides it is hid from view; but the lever may be placed over or under a common or single jib, in which case it would then be exposed to view. The fulcrum of the lever, G, is at H, and may be either rigid or suspended in a link, as may be most convenient. The longer end of the lever is prolonged to the centre of the pillar of the crane at I, where it terminates in knife-edge centres. From I is a connecting rod, K, which descends to the steelyard at L, to which it is connected by a shackle and knife-edge centres. The steelyard itself, so far as regards construction and adjustment, is similar to those before described—except, only, that it is a lever of the second order, having its fulcrum at the extremity of the shorter end, and instead of a suspended link sustaining the fulcrum, that fulcrum forms part of a rod, M, which descends below the steelyard, and passes through a guide or eye, N, in which it is at liberty to move freely, so as to admit of a small extent of oscillating motion in the steelyard, in order to prevent any friction from rigidity. The disengaging fulcrum rod, M, is shown in detail in fig. 22. It has a frame, O, within which is fixed an eccentric wheel, P, having its axis connected by proper centres with the pillar of the crane. Upon the axis of the eccentric is keyed a hand lever, Q, the design of which is to relieve the centres and all other parts of the weighing machinery from strain or wear during the time of hoisting, and at all other times, except when in the act of weighing. The manner in which this effect is produced is as follows:—When the crane is used for hoisting only, the hand lever, Q, is in the vertical position indicated by the dotted lines, R, and the shorter end of the steelyard and the long lever are raised to the extent of the eccentric action, and the square bearing shoulders of the bearing hook and shackle, D, are brought down to the stationary resting bed upon the jib, S. In this state, the weighing apparatus is entirely quiescent, and the crane is merely an ordinary hoisting machine. When a load is lifted by the crane, which it is desired to weigh, the hand lever, R, is drawn down to the horizontal position at Q, and made fast to a staple or catch fixed to the bracket, T; by this movement the hand lever acting by its eccentric wheel upon the steelyard and long lever, raises the bearing hook and shackle from its bed, and puts all the parts of the apparatus into a weighing state. As the length of chain between the bearing hook and shackle, *D*, and the body, A, to be weighed, is liable to considerable variation, it will be necessary in order to accurate results that the weight should be ascertained when the load to be weighed is at one given height from the ground. For this purpose I make an indicating link, U, in the chain, which is very obvious to the view, and which link on its arriving opposite to the indicator, V, fixed upon the axis of the live pulley, C, marks the altitude at which the load may be accurately tested. Upon the chain immediately under the hook and shackle, D, is a large hollow ball of cast iron, W, having a cased passage through its centre (vertically) to admit the chains, and being perforated by a screwed hole on its upper side, X, through which hole lead, either in a melted state or in the form of shot, is to be poured into the chamber for the purpose of counterbalancing the dead weight of the parts composing the weighing apparatus; or the requisite counterbalance may be attached to the long lever if preferred, or provided for in any other suitable way. After the crane has been first fixed, all subsequent corrections of the balance may be effected by the internal steelyard adjustment before described.

We look upon this as being an exceedingly useful machine. In many cases a great deal of time may be saved by being thus able to lift and weigh at one operation; and in other cases it will furnish a convenient means of weighing bodies, which in consequence of their great bulk and awkward form it would be difficult, if not impracticable, to place upon any platform weighing machine.

Bank Notes.—A paper-manufacturer of Massachussets has made some important improvements in bank-notes, with a view to the detection of forgery. The invention consists in introducing into the body of the paper cotton threads, whose number show the value of the note; thus, under "five dollars," the notes contain one, two, three, four, or five threads; six dollars, six threads; seven for twenty; eight for fifty, nine for one hundred, ten for five hundred, and eleven for one thousand. There will thus always be an indelible sign to guide one in the value of the note, however the letters and figures may have been altered. Several banks in New York and the East are making preparations for the adoption of this paper, and it is expected its use will become general.—*United States Courier.*

Digitized by Google

GASKIN'S SOLUTIONS OF GEOMETRICAL PROBLEMS.*

There is one remarkable feature by which nearly all the Cambridge text-books and syllabusses are strongly marked: a total want of all reference to the *history* of mathematical science. Even if in any particular case, a reference to some problem that has been previously and amply discussed, should be made, the manner in which it is made proves undeniably, that it is taken not at second-hand, but at twentieth-hand. Whatever is given in these books is almost invariably given in such a form that the reader is left under the impression of the writer of the book being the real author of all that it contains. We shall have occasion, presently, to apply these remarks, and to show the tendencies of all those systems of education which do not in some degree include the history of the mathematical and physical sciences.

In the article "Descartes at Cambridge," inserted in our last week's Number, the writer had in view to show one important defect, and the consequences which ensue from it, in the present academic system of mathematical tuition. He had before him not only Mr. Gaskin's solutions of the geometrical problems of St. John's, but likewise a very able work written by another Cambridge man, Mr. G. W. Hearn, Professor of Mathematics in the Royal Military College. Want of space alone prevented the reviewer from giving, as a pendent to his own remarks, a paragraph from Mr. Hearn's book;† but the omission may here be supplied. It must be noted that Mr. Hearn is an ardent advocate for what he calls "the *supremacy* of analytical mathematics;" and it must be confessed, that as far as his *argument* (rather than his *conclusion*) extends, he has acquitted himself with great skill:

"The fact is, that for several years past it has been the custom for incipient graduates, after having passed the senate-house examination with more or less credit, to take pupils. Now those tutors (many of them highly estimable men, and men of sterling talent,) are often very inexperienced, probably most of them thoroughly ignorant of mathematics only three years previous to entering on their tutorial occupations. But education, like every thing else, requires study, thought, and experience. A young tutor may be a highly talented individual, and yet a very bad teacher. He has forgotten the difficulties experienced by himself, and perhaps never known those experienced by others. He cannot believe it possible that any being born with reasoning faculties can stumble in going over the Pons Asinorum, or fail to understand the Binomial Theorem, and a thousand other minutiæ. He therefore takes too much for granted as to the state of knowledge of his pupil; and all pupils are anxious to conceal rather than display ignorance.

"The tutor, therefore, taking it for granted that his pupil is already possessed of the appropriate preliminary ideas, ushers him too rapidly into the domains of analysis. The pupil appears to progress rapidly, feels perfectly satisfied both with himself and his tutor, and soon begins to fancy that he *may be* Senior Wrangler. He can solve any quadratic, separate roots, draw tangents and assymptotes, differentiate and integrate like harlequin, and all this after having read only three terms. But he cannot do the simplest deduction from Euclid, has no idea of a geometrical limit, makes sad bungling of a statical problem, and does not understand Taylor's Theorem.

* Solutions of Geometrical Problems, consisting chiefly of Examples in Plane Co-ordinate Geometry, proposed at St. John's College, Cambridge, from Dec. 1830, to Dec. 1846: with an Appendix containing several general properties of Curves of the second order, and the determination of the magnitude and position of the axis of the conic section represented by the general equation of the second degree. By Thomas Gaskin, M.A., late Fellow and Tutor of Jesus College. Cambridge, Deighton; London, Parker; 1847.

† "Researches on Curves of the Second Order." London: Bell. 1846. This work is less known than its great merit deserves. It is addressed, however, only to those who already possess a fair degree of acquaintance with the co-ordinate methods. We should add, that Mr. Hearn was sixth wrangler of his year; and therefore, we should think, that even at Cambridge he would be admitted as a competent authority on its modes of tuition. We hear it, however, continually made a matter of complaint by non-resident university men, that the resident members of the senate "systematically put them aside by a lot of petty manœuvres." These "manœuvres," we fear, are not confined to mere matters of academic government, but to the infinitely more important one of advancing the cause of science. Mr. Hearn's book is unappreciated and unknown in his university; and Mr. Gaskin is the only author who has even alluded to it—which, however, he does honestly and honourably. Mr. Hearn is *non-resident*—and that is enough!

Digitized by Google

"This state of things continuing, he is ushered into Dynamics, Lunar and Planetary Theories, &c. &c., and becomes ready for the Tripos, from which he emerges last of the Senior Ops, retires from Cambridge, and is puzzled all his life long to find out what is the use of a University education.

"Had such a youth been in the hands of an experienced person and distinguished mathematician, who would have taken care to *educate* him properly, who would have carefully *completed the links* connecting geometrical and algebraical reasoning, who would in every analytical investigation have kept the ideas appropriate to the subject of investigation constantly before the mind of the pupil, who would have shown him in many cases the identity of analytical and geometrical reasoning, and that in all cases the former is as it were the sublimation of the latter; then indeed it would not have been

"'Parturiunt montes, nascitur ridiculus mus.'"

We have so recently noticed Mr. Gaskin's Solutions of the Trigonometrical Papers of St. John's, and the opinion of the author's skill as a "problem-solver," which we then expressed, is so completely borne out in this new work, that we can only designate it as a superior one *of its kind*. In fact, the one work is strictly a continuation of the other, and the composition of the two is so strictly in due keeping, that whatever is said of the one *must be* said of the other—with however, a single, but important exception.

Trigonometry is, properly speaking, not only one of the *legitimate* applications of algebra (or generalised arithmetic) to geometry, but in the natural as well as the historic order of the development of the mathematical sciences, it is the *first* application. As may be expected, it will also very frequently supply *brief* methods of establishing geometrical properties, and of solving geometrical problems; and though we are not disposed to look favourably on the method when used to supersede the ancient geometry, we have not the slightest objection to its use for either deducing or resolving, when professedly used as a trigonometrical *praxis*, or in illustration of the relation between the pure and the mixed geometries. We, therefore, in the most full and cordial manner expressed our entire approbation of Mr. Gaskin's former work.

The present work, however, stands in a different position; which we will explain. The papers given at St. John's, which he has here selected, are the professed papers on *geometry*, and not on the *geometry of co-ordinates*. These are the papers which contain *all* that is proposed in connection with the ancient geometry, or even in connection with the *géométrie supérieur* in that college. We should, therefore, have anticipated that the resources of the ancient, and especially of the *modern* continental geometry, would have been very prominently brought into effective operation amongst these solutions. A better opportunity could not have been desired—could not have been created. Mr. Gaskin, however, instead of moving with the times, and availing himself of researches ready to his hand, goes back to the Cartesian organon, and throws the whole weight of his influence into a support of "the supremacy of analytical mathematics!" Does Mr. Gaskin really mean to imply that the ancient geometry in its pure form, and the researches of Monge and Carnot, and their illustrious disciples, Poncelet, Ollivier, and Chasles (the greatest of them all,) for instance—are so utterly unworthy of all Cambridge regard as to be alike "swamped" in the "vortices" of the Cartesian whirlpool? It is, indeed, a "maelstrom;" and all other modes of treating geometry than this one have little other academic prospect than that of the unfortunate mariner who ventured within the "suctional area" of that awful gulph, the descriptions of which so often made us shudder in our juvenile but adventurous days.

There is one very marked difference between the ancient and the Cartesian geometry in "the manner of setting about the solution." It is this—that whilst the Cartesian forms at once his equations expressive of the conditions of the problem or the hypothesis of a theorem, the geometer proceeds by successive and consecutive steps from one property to another till he at

Digitized by Google

length arrives at the truth, or the construction, which he is investigating. The Cartesian of recent times has in a great degree abandoned this great feature of his method, and condescended (without acknowledgment, however,) to copy the processes of the antient geometry; and instead of his vaulting at once to his final solution, like the bird of Jove to his eyrie, he creeps along from one stepping-stone to another with a consciousness that his pinions are shorn, and powerless for flight. Those who have most successfully cultivated the Cartesian geometry have most closely copied the manner of procedure which distinguishes the ancient; nor is Mr. Gaskin an exception to this rule.

No doubt he has made the best he could of his subject; but the defects in the method itself could not be eradicated even by him. This is no reproach; neither is it intended to throw a shadow of doubt upon his full possession of the high "analytical power" which is universally conceded to him in Cambridge. We have read with great care a considerable number of his solutions, and we have met with few instances where we could suggest any material improvement. This, at least, will not be considered the confession of hostility or intolerance. Still it is remarkable that Mr. Gaskin nowhere even hints at the necessity of interpreting the final result—at least we have not found an instance. He simply forms the equations implied in the question, gets out the stated result, and then considers the solution finished. It is against this negligence of a *principle*—against a habit which Cambridge studies inevitably engender—that we raise our voice. A better book than Mr. Gaskin's, on the principle he has adopted, could not we think be produced by any man living: but we want more, much more, than this.

As these "geometrical problems" are solved on the same plan as the "trigonometrical," we may assume that he has "adopted the method which the nature of each example suggested, in preference to the employment of analytical artifices, by which many of the results might have been obtained more concisely." We do not, however, we must avow, understand why there exists the least necessity for Mr. Gaskin to confine himself, in a printed book which is to be studied at leisure, to the cramping necessities which the limited time of an examination in the Senate-house may impose upon the under-graduates at that particular juncture. We should certainly have considered that a publication such as this afforded a very favourable opportunity for rendering those "analytical artifices" intelligible to the men; and that a most desirable occasion had occurred for enforcing attention to the signification of the results and the evidence of the steps by which those results were obtained. These read in private by the undergraduates would have been beneficial in every sense—infinitely more so than ten times as many solutions "written out," even though given in the able, and often adroit, manner of Mr. Gaskin. Men might have been led to *think* as well as taught to *work* at the same time.

Mr. Gaskin states that these questions "have been proposed by some of the most distinguished members of the Society [of St. John's]; and that the generality of the results are remarkable for their neatness and simplicity." Now, to the term "proposed," if we are to understand "invented," we most emphatically demur. We have met with a very small number of questions amongst this list that have not been perfectly familiar to us for many years—and most of them long before the period at which these papers commence. We will add more—that we discover traces of even the *Diaries*, as well as the "Transactions of learned Societies," having been consulted to form this series, as well as many other college and Senate-house papers. Now, it is somewhat ungracious for Cambridge men, when they know that more than two-thirds of the questions in every paper have not the shadow of a claim to originality, to hold up the questions so selected as being of Cambridge origin. The many elegant theorems and problems respecting lines of the second order, which are included amongst these

Digitized by Google

Johnian papers, are, so to say, "as old as the hills;" and those remarkable ones in Mr. Gaskin's second Appendix are more familiarly known to the French and German geometers than the Elements of Euclid are to the great majority of Cambridge men. Such assumption of originality in these and other such problems bespeaks either great disingenuousness or great ignorance of mathematical literature beyond that of the University itself. We confidently believe that the latter cause is the true one as regards Cambridge men in general; though, possibly, to a small section, the first explanation will more properly apply. The men, as we have urged in the early part of this review, are not trained to look into the *history of science*: they hence spend their time in the invention of problems and the discovery of theorems in a bit-by-bit and desultory manner, and are rewarded by turning up now and then a few of those curious relics which to a well-read mathematician are mere "mare's nests" whilst, as the old phrase runs, the discoverer "stands chuckling over the eggs." We cannot express how much and how deeply we have been disgusted to witness such scenes.

We have a case in point before us. One of the questions in the series, No. 4, is this:—"To inscribe in a circle a triangle whose sides, or sides produced, shall pass through three given points in the same plane." Mr. Gaskin's discovery that it was not one of those invented by "a most distinguished member" of St. John's College, originated in a remark made by Mr. Hearn ("Curves of the Second Order," p. 15); and Mr. Hearn's own knowledge of the subject is deduced from Montucla, or more probably from his superficial and supercilious editor, Lalande. Yet our readers have only to turn to Potts's "Appendix" to learn how many other writers have treated on this problem and its generalisations; whilst these Cambridge authors are satisfied to print their own researches without examining whether any one of all those many authors had anticipated them in method and result! Able men do injustice to themselves as well as to others by this procedure. How stands the case here? Mr. Hearn was entirely anticipated as to the *method* pursued nearly forty years by Gergonne, Servois, and Rochat—who also extended the method to the conic sections: whilst Mr. Gaskin was anticipated in his *construction* by Lhuilier before the close of the last century. We believe, however, that Mr. Gaskin in his method of investigation stands alone; and a most effective and elegant method it is—a perfect master-piece in its way. It is a full and effective answer to the half-challenge with which Ottajano concludes his paper on the geometrical solution of the same problem.

It appears that after Mr. Gaskin's work was printed off, he met with Swale's "Apollonius," in which is given a geometrical construction "of the description of a polygon in a given circle, each of whose sides shall pass through a given point;" and some modifications of the preliminary propositions and the constructions have been extracted by Mr. Gaskin, to form his "third Appendix." We doubt, however, whether most readers will not give the preference to the original form; and as to the construction to be derived for *any polygon* and any conic section, we believe that those geometers who have paid most attention to the problem are convinced of the hopelessness of equalling that of Poncelet, which is effected by the *ruler only*.

Mr. Gaskin has also sent us some generalisations of Swale's construction, where the conic sections are substituted for the circle. A personal friend of ours, who has paid great attention to the *history* of the problem, and who has been some time preparing a paper on the subject for press, had some time ago made a similar extension of Swale's method. We felt, therefore, in a dilemma as to printing Mr. Gaskin's; but upon consulting our friend, he not only did not object, but with the utmost frankness urged its appearance, waiving all claims to priority, and resigning the subject to Mr. Gaskin's investigation. This we think the more liberal, as we know our friend was in possession of the extension long before Mr.

Digitized by Google

Gaskin had ever seen or heard of Swale's "Apollonius." We hope to print it soon, when our readers will be able to judge for themselves; but meanwhile, we venture to say, that it betokens Mr. Gaskin to possess geometrical power nearly akin to his symbolical; whilst at the same time it bespeaks much less of practical dexterity in the use of the one method than in the other. Time and perseverance will completely remove the disparity in this respect; and we shall hope to see that due admixture of the Cartesian and the ancient geometry displayed in his future writings, which bespeaks the perfectly-poised geometrical mind.

We may notice likewise another instance of the unfortunate effect of want of attention to the study of other than University works by Mr. Gaskin. At p. 245, he gives an investigation of Pascal's theorem (the celebrated mystic *hexagram*,) which brought very forcibly back to our minds, a solution which had been given a few years previously in the *Lady's and Gentleman's Diary*, for 1843, (p. 71.) If, indeed, there be any difference between the two, it is in favour of the Diary solution—a decided proof, at any rate, that Mr. Gaskin is not a copyist. The *principle* is essentially the same in both, and the details differ in no important particular; the Diary solution is confessedly taken from Magnus of Berlin—an author to whom more than one English geometer is indebted to a greater extent than has been avowed with that clearness which strict candour would require. We are, we confess, somewhat perplexed to account for this coincidence; since it requires the employment of Lagrange's method of *conditional multipliers* (very generally, but very absurdly, called "arbitrary multipliers,") which Mr. Gaskin has used so sparingly throughout his work, that we almost fancied he must have had some special objection to the principle itself. We, indeed, grant that the principle is laid down in a very slovenly, and often erroneous, manner—we even grant that no good philosophical explication of it has ever fallen under our notice:—yet it would have been a subject admirably adapted to Mr. Gaskin's talents to have developed and applied the principle; and the present work furnished a fitting occasion for it. In a second edition, we have no doubt that this point will receive proper attention from him.

This mention of Pascal leads us to revert to a former remark of ours, relative to the halting step of the Cartesian geometry in its progress through an investigation of any especial difficulty. In this supplement (the second) we see that a few of the cardinal properties are deduced by coordinate considerations (all of which might have been, and have often been, obtained by pure geometry with equal brevity and greater elegance—as for instance Pascal's theorem in the Diary referred to;) and *then* recourse is had to *geometrical deductions* of the consequences! This species of legerdemain we hold to be both unscientific and mischievous: the product is "neither flesh nor fish," as our Catholic ancestors used to say. But we desist from further remark just now; and that under a confident belief that this "hotch-potch" method of investigation is approaching its death-struggle.

We have taken our exceptions to Mr. Gaskin's book in no captious spirit, but with perfect freedom and in perfect sincerity; we hope, too, without giving the least personal offence or personal pain to its distinguished author. We respect both his character and talents too highly to give either offence or pain intentionally: but on public questions of science and education, we hold ourselves at perfect liberty to discuss the character and tendencies of any work which comes before us; and that without considering who may be its author, except as far as the author's position is one which facilitates the diffusion of truth, or the propagation of error. We have differed from Mr. Gaskin with regret: but we *do differ on first principles;* and we cannot but feel sorry that he has not done *himself* the justice that was almost forced upon him by the undertaking in which he was engaged.

We are still more sorry to see this

Digitized by Google

work making its appearance *at the present juncture*. The papers on which he has founded his solutions are, professedly, the *geometrical* papers of St. John's—some of them, though not very many, are strictly geometrical: and the greater part can be solved by means of transversals and other *geometrical* methods. Why, then, should Mr. Gaskin have gone out of his way to apply the Cartesian method to them all? Often, too, at the expense of much labour, and obtaining a solution far inferior to the geometrical one after all! He displays great mastery over his instrument, it is true; but we must, notwithstanding, be allowed to question the soundness of that judgment which attempts to efface all traces of the ancient geometry from the Cambridge papers. He tells us, too, in the preface to his former work, that "in every case he has endeavoured to point out the form in which the student would be expected to present the solution to the Examiner;" and, of course, the present one is constructed on the same plan, and with the same objects. He, therefore, virtually tells the undergraduates that they are "expected" to *solve every geometrical problem by means of coordinates!* Now, in connection with this, we must remember that Mr. Gaskin is one of the Moderators for the coming examination; and that, on that occasion the "Graces" of May, 1846, which enforce something more of attention to geometry than heretofore, come into operation. Mr. Gaskin has, consequently, put himself in an unfortunate position by the publication of this book, whilst he is appointed to officiate as Moderator on so critical an occasion. We have that confidence in his high sense of honour, that we do not for a moment suppose he will betray the trust reposed in him, by accepting, as solutions of purely geometrical problems, any of the attempts that may be made to palm upon him, solutions constructed on the principle of his own work. His false position, then, is this:—That he has issued a series of model-solutions of geometrical "problems" which the men will naturally accept as an exposition of the views of their Moderator; whilst he is in strict honour bound to admit nothing of the kind, and to insist upon totally different methods of solution. Being thus pledged on both sides of the same question, his dilemma is anything but an agreeable one: but we trust the great interests of the University and of accurate science, will be considered by him as paramount to any implied liability to the contrary, which he may suppose he has incurred towards the purchasers of his work. We have the fullest reliance upon him ourselves.

In conclusion, we wish Mr. Gaskin safely through the opening month of the year, untouched in his honour, and unscathed in his feelings. We shall watch his progress with anxiety, and shall gladly congratulate him on the successful achievement of his arduous and difficult task. We shall gladly welcome him back to the labours of science; although we could wish them to be bestowed upon subjects more worthy of himself and of his reputation than writing model-solutions of mere college problems.

CAUSES OF THE FRACTURE OF AXLES.

Dear Sir,—A letter in the *Times* of Saturday last, giving an account of the breaking of an axle on the Lancashire and Yorkshire Railway on the previous Tuesday, has reminded me that I threatened to inflict some remarks upon your readers on the fracture of railway axles, provided you thought my letter on buffers worthy of insertion, (which I am happy to say you did.)

The continuance of the evil, although not recently attended with fatal consequences, shows the necessity of continued attention to the subject.

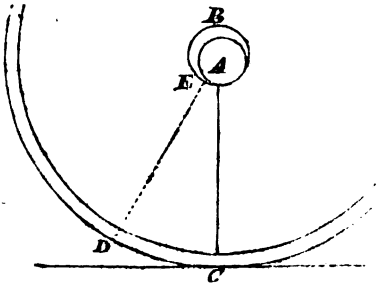
I am disposed to think well of Mr. Bessemer's improved axle (see *Mech. Mag.*, May 29, 1847,) but not exactly for the same reason as that which he advances as the chief argument in its favour, viz., that it will prevent *crystallization* of the iron by the *torsion* to which railway axles are subjected. Although torsion, doubtless, does occur to some extent, yet I believe that it is never sufficient to cause the fracture of such axles; because there is not enough

Digitized by Google

friction between the wheel and the rail to produce the torsion of the axle beyond the point of elasticity. I think also that Mr. Bessemer has too hastily concluded that crystallization results from torsion. My own observations lead to quite a contrary conclusion. The effect of torsion on any fibrous substance is to produce separation of the fibres longitudinally—to destroy their lateral cohesion—as will be readily seen by "the twisting of a wire, or the bending a stick backwards and forwards," as Mr. Bessemer suggests. That which was a stick or a wire, by continued twisting in alternate directions, becomes a bundle of fibres, having little or no lateral cohesion. As long as these fibres are not twisted far enough in either direction to draw the particles of the substance beyond the distance within which they mutually attract each other, so long do the fibres retain their tenacity, notwithstanding their separation; but when that distance is passed, the outermost fibres (which have the greatest strain, being farther from the axis of motion) separate one by one, and the whole mass is ultimately torn asunder. In this process there certainly is nothing that tends to produce crystallization; and in the case in point there is the less probability of the particles being drawn beyond the limits of mutual attraction—in other words, beyond the point of elasticity—because the axle is not subjected to any considerable amount of tension as well as to torsion, but rather the contrary. If, therefore, it is improbable that the excessive torsion of the axle takes place, and if it be nearly, if not quite, certain that torsion does not produce crystallization, we may fairly conclude that torsion is not the chief cause of fracture. If it were so, the separated parts would appear fibrous, or as if torn asunder, and not crystalline, which I believe they invariably are.

It appears to me that the chief, if not the only, cause of fracture is *uninterrupted vibration*. Mr. Bessemer shows by a calculation that the axles of an omnibus are apparently subjected to a much larger amount of vibration than those of a railway carriage; why, then, if vibration be the cause of fracture do not the former more frequently break? First, because the wheels being higher and more elastic absorb a large portion of the vibration. Second, because the wheels move freely on each end of the axle, and the bearings are *inside* of the wheels. When, therefore, the vibration reaches the axle, it has been diminished by its passage through the wood of which the wheel is made, and it is free to flow out at each end of the axle uninterruptedly. Besides this, I am not quite sure that the vibration caused by the concussions of an omnibus wheel on the stones ever reaches the axle at all, because of the continuous revolution of the wheel.

The following diagram will illustrate my meaning: the two inner circles, excentric to each other, show the nature of the contact between an axle and its box (which being fixed to the wheel must be considered as a part of the wheel.) A, is the axle; B, the box. They are in contact, when in motion, only at a point



a little forward of the centre, at the lower side of the axle. A concussion takes place at C, but owing to the continued revolution of the wheel, the point of impact, C, probably has reached D, before the vibration has reached the centre of the wheel. At D, it will be seen that the wheel is not in contact with the road, nor its box, at the point E, perpendicular to D, in contact with the axle; the wheel, therefore, may vibrate without affecting the axle at all. If it should be objected to this, that the box fits too closely to the axle, it may be replied that, strictly speaking, they are not in actual contact anywhere, particles of oil, or some other lubricating substance being interposed between them; which as they *certainly* keep the particles of iron beyond the point of mutual attraction, may also prevent the trans-

Digitized by Google

mission of vibration from the box of the axle. The nave of the wheel, too, with its grain at right angles to that of the spokes, serves as a cushion to deaden the jars which they communicate. All those things are in favour of the omnibus axle, besides others which might be mentioned; such as the lower rate of velocity, and the absence of any centrifugal motion in the particles of the iron, owing to the circumstance of the axle being fixed, and not revolving like those of a railway carriage.

The immediate cause of the crystallization of railway axles is, undoubtedly, the wheel being so firmly keyed to the axles that they may be considered as one mass. All the vibrations which the wheels receive they faithfully transmit to the axles; the wheels are of too small diameter and too rigid. The greater part of the vibration which the axle receives is thrown towards the centre, because the outside bearings prevent its transmission outwardly; before the wave of vibration which the axle receives has expended its force, it is met by another wave coming from the other side; the particles of iron repel each other at the point where these opposing forces meet, and dispose themselves at right angles to the general mass of the axle; these distributed particles prevent the transmission of subsequent vibrations; other particles assume similar positions, varying according to the amount of force transmitted to them and the attraction of surrounding particles; and thus gradually the whole mass becomes irregularly crystallized.

When a piece of iron is broken asunder, by repeated blows of a hammer, *all one way*, it is found that the fracture appears half crystalline and half fibrous, the latter being on the upper side which received the blow, the former next the anvil or vice; the upper side being convex has been stretched, as it were, in the process, and the fibres consequently torn asunder—the under side has been compressed, and the *return* vibration from the anvil has polarized the molecules, giving them a new arrangement transversely to their former one.

Something analogous to this takes place with respect to a railway axle, the whole weight of the body of the carriage being supported at the extremities of the axle outside of the wheels; that part of it between the wheels, which happens to be uppermost, is to a certain degree in a state of tension, and the lower side in a state of compression, which is increased by the lateral concussions of the wheels against the rails. At a lower rate of speed it is probable that the vibration may not reach the middle of the axle, but at a high velocity, no doubt the blow given is sufficient to send it to the opposite end if it were unopposed. It is the outlet given by Mr. Bessemer's arrangement, for the vibration of each half of the axle to expend itself without affecting the other half, which induces me to think well of it, provided it be so made that the ends within the coupling-box be not in actual contact, and that some non-vibrating substance (as leather) be placed between the coupling-box and the axles; but I object to the concentric rings sunk in the axles, because they would diminish their capacity for the transmission of the vibrations, and the ends would in consequence be liable to jar off, as the screwed ends of bolts frequently do.

Another plan would be to make the axle of one wheel hollow, and that of the other wheel solid, placing the one within the other through nearly its whole length. They need not be in contact except at the ends, so that each vibration would have nearly the whole length of the axle to travel; but even in this case the same precautions as I have suggested above would be necessary to prevent communication of the vibrations from one axle to another.

I have not mentioned all the injurious influences to which the railway axle is subject, but as I think I have inflicted enough of my tediousness upon your readers for the present, I will only ask pardon if I have stated too dogmatically what may be in some measure only hypothetical, and subscribe myself,

Yours, very respectfully,
JAMES ROCK, Jun.

P. S.—Since writing the above I have received your last Number, wherein I perceive that an axle similar to that which I have suggested above has been patented. You will remember that I mentioned the plan to you in August last.

Hastings, December 15, 1847.

Digitized by Google

ON THE LAW OF CONNECTION OF BERNOULLI'S NUMBERS.

BY PROFESSOR YOUNG OF BELFAST.

(Concluded from page 575.)

If, as is usual, we represent the numbers of Bernoulli, with their proper signs, by

$$1, B_1, B_2, B_3, B_4, \&c.,$$

then the foregoing development will be thus expressed:

$$\frac{x}{e^x-1} = 1 + B_1 x + B_2 \frac{x^2}{2} + B_4 \frac{x^4}{2.3.4} + \&c.$$

And if the object be merely to deduce these numbers, or to determine the law which connects them together, independently of the numerical divisors of the powers of x, then it will be necessary to assume this independence in the conditional coefficients (page 574). We may thus write the identity at page 574, of which the first member is x, as follows:

$$x = \left(x + \frac{x^2}{1.2} + \frac{x^3}{1.2.3} + \frac{x^4}{1.2.3.4} + \frac{x^5}{1.2.3.4.5} + \&c.\right) \times$$

$$\left(1 + 2B_1 \frac{x}{1.2} + 3B_2 \frac{x^2}{1.2.3} + 4B_3 \frac{x^3}{1.2.3.4} + 5B_4 \frac{x^4}{1.2.3.4.5} + \&c.\right)$$

From which we deduce, as already explained, the following conditions: viz.

$$2B_1 + 1 = 0$$
$$3B_2 + 3B_1 + 1 = 0$$
$$4B_3 + 6B_2 + 4B_1 + 1 = 0$$
$$5B_4 + 10B_3 + 10B_2 + 5B_1 + 1 = 0$$
$$6B_5 + 15B_4 + 20B_3 + 15B_2 + 6B_1 + 1 = 0$$
$$\&c. \qquad \&c. \qquad \&c.;$$

in which expressions, when taken in reverse order, we recognise the law of the binomial coefficients, the final coefficient, in each case, being absent. If therefore in the development of $(1+B)^n$, we remember to write the several exponents of B, as they arise, *below*, instead of *above* that symbol, we may express the general law, under which the preceding particular cases come, by the following form: viz.

$$(1+B)^n - B_n = 0$$

which, as n is necessarily a whole number, may always be expeditiously developed by deducing the several coefficients one after another in the usual way, all of them being integral.

Although for the purpose of carrying on this successive derivation of the coefficients one after another, it is proper that they be written down in order, without any omissions, yet it is of importance to notice that every B with an odd index, except the first one, B_1, will vanish; that is, every such B, to satisfy the above law, must be zero; so that though, for the sake of the coefficient, a B with an odd index be written down in its proper place in the development, no time is to be spent in computing its value: that every such B is zero is easily shown thus:—

Whatever be the development of the proposed function (p. 574), it is plain that if we write under it what the development becomes when x is negative, and subtract, the even powers of x will disappear from the remainder, but all the odd powers will be retained. Now,

$$\frac{x}{e^x-1} - \frac{-x}{e^{-x}-1} = \frac{x}{e^x-1} + \frac{x}{\frac{1}{e^x}-1} = \frac{x}{e^x-1} - \frac{xe^x}{e^x-1} = \frac{x(1-e_x)}{e^x-1} = -x,$$

so that the only odd power of x involved in the remainder is $-x$; which authorises the exception above provided for. And this is the usual way of proving the absence of all the higher odd powers of x, and consequently, that every B with an odd index, B_1 alone excepted, must be zero.

Digitized by Google

Sir,—An important step has been at length achieved in the appointment of a commission to supersede the numerous trusts whose care was to look to the sewerage of the metropolis. Whether this step has been brought about solely by the great and unceasing cry that has gone forth for sanatary reform, or has been urged upon the authorities by the apprehension of the approaching cholera is of little consequence. I fear however that the non-interference with the city authorities, whose privileges are not, in this case, to be interfered with, will cause considerable hinderance in the effective working of the new commission.

A Sanatory Bill, such as we hoped ere long to see passed, must legislate on a great variety of subjects in order to exterminate the nuisances that have been suffered to exist in our towns, filling our hospitals with sick, and the burial-grounds with those who, but for the vile atmosphere in which they lived and died, might still have continued useful members of society.

Amongst the subjects to be embraced by an effective sanatory measure may be enumerated—ventilation, public and private; improved sewrage and drainage; increased supply of water; abolition of intermural burials; paving, lighting, and scavengering; baths, washhouses, &c., &c.

Theory has done much for the subject of ventilation—practice but little. Much has been said and written on the subject; but those who visit our crowded churches, theatres, and other places of general resort, are still compelled to breathe a vitiated atmosphere wholly unfit for respiration.

A healthy adult requires a certain quantity of air for respiration per minute; one hundred persons collected in a room together, require one hundred times as much, which multiplied by 60 and divided by the capacity of the room, gives the number of times the room should be filled by fresh air in an hour, and this again compared with the areas of the apertures that admit the air will give the velocity of the current of fresh air flowing into the room. All this is very simple. It is equally easy by artificial means to produce this current, and it no doubt is produced; yet in the middle of the room the crowd still pants for fresh air, and if we were to test the air which is flowing out of the room, we should find it scarcely more vitiated than that which the people are inhaling within it. It is not only necessary that a sufficient quantity of air be admitted in to the room, but that it should also be diffused throughout, which can only be effected by abstracting the foul air opposite to the part where the fresh air is admitted, and then causing a gentle current direct through the room. Now this is a thing which I fear hardly any known system of ventilation can be said to accomplish effectually.

The vital portion of the air we breathe is as necessary for the support of combustion as of life. Flame can no more be produced without a due supply of oxygen than life can be supported under similar circumstances. We may reasonably suppose that the same operation, though in a less violent degree, goes forward in the lungs that is perceptible in the furnace. At least the products evolved are the same, the oxygen mixing with carbon producing carbonic acid gases, and with hydrogen forming water; and these noxious gases, with nitrogen in a free state, are given off both from the lungs and from a well-regulated furnace.

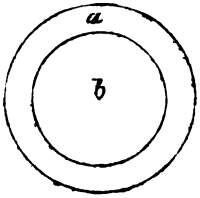
Since, then, there is such similarity between the vital principles of flame and life, it is but reasonable to suppose that that principle which is found to afford the greatest brilliancy of the former, will be best adapted to the ventilation of rooms for the preservation of the latter.

Observe the flame of a candle. It consists of a thin film of white hot vapour, which constitutes the light evolved by the candle; this light is superficial only, for it encloses an interior portion of unconsumed carbon which cannot burn for want of oxygen. If by means of a blow-pipe air be admitted to this interior portion the light is greatly increased. The construction of the flame aptly represents the conditions of a crowd met together in the open air, though the great heat of the candle would exhibit the evil more glaringly than is felt by the crowd. The exterior of the flame alone gives out light; the interior part for want of oxygen is incapable of emitting it; animal life could not exist in such an atmosphere; and so it is with a crowd, though in a less degree. The individuals composing the

Digitized by Google

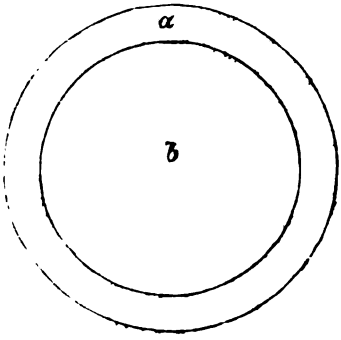
exterior ring of the assembly are well supplied with fresh air, but those towards the denser parts will have a vitiated atmosphere to breath, consequent upon its having to pass through and mingle with the impure gases arising from the outer members of the crowd. Thus, let fig. 1

Fig. 1.



represent a horizontal section of the flame of a candle; *a*, the luminous ring, and *b*, the dark interior. So, similarly, fig. 2, would represent the state of the

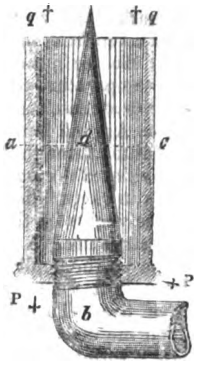
Fig. 2.



atmosphere breathed by a crowd; *a*, being the comparatively pure exterior; *b*, the exceedingly impure gas in the interior.

Let us pursue this inquiry further; but instead of the open flame of a candle, let fig. 3, represent a gas lamp; *b*, a pipe, conveying the gas; *d*, the flame; and *a*, *c*, the chimney-glass enclosing the flame. First, let the diameter of the flame be the same as the pipe, and let the only supply of air to support combustion come in the direction of the arrows, *p p*, or down the chimney-glass, *q q*, (if indeed it could be admitted this latter way). This state of things will not inaptly represent a room crowded with people and ventilated round the sides. For the

Fig. 3.



chimney-glass represents the walls of the room, and the flame the people. If we take any section of the flame through *a*, *d*, *c*, it will present the appearance of fig. 1, and similar remarks are applicable to it. The centre of the flame is dark. And the air in a similarly ventilated room would be unfit for respiration in its crowded centre.

Again; some plans of ventilation admit the air at the level of the ceiling, and abstract through the ceiling. Let us see the effect of this. By stopping up the aperture (*pp*) the gas would pass through the chimney glass unconsumed, and not take fire until it arrived at the top, thus making the chimney glass merely as an enlargement of the pipe to convey the gas.

The Argand burner produces a more brilliant light by confining the flame to within proper limits; and this principle, so effective in producing light, I would consider the best for ventilation.

It may be objected, that the above illustrations are not analogous, inasmuch as the temperature of a flame greatly exceeds that of a room under any circumstances; and, secondly, because I arrive at conclusions without sufficient reason.

To the first of these objections I would reply,—That their illustration exhibits a very exaggerated view of an ill-ventilated apartment; for life could not be supported under such circumstances if they did not. And, secondly,—Any reasoning on the points would greatly exceed the intended limit of this communication, which is written with a running

Digitized by Google

pen, and without any intention of entering into chemical or mathematical details.

I have remarked, above that the foul air should be taken from the room opposite to where the fresh air is admitted; and as the temperature of the room causes the air to ascend, it appears to me that, like the Argand burner, the air should be admitted through the floor, and pass off when vitiated through the ceiling. A maltster's kiln exemplifies this, and is, perhaps, better ventilated than any other description of structure. A maltster dries his malt more by the application of air passing through it than by the direct application of fire. To effect this, the floor on which the malt is laid consists of perforated tiles, through which the heated air ascends, and, passing through the malt, escapes by means of a cowl in the roof. The perforated tiles forming the floor admit the air to every part of the room, and a constant current under complete regulation is passing through the room and out of the roof. Now, Sir, it would be a very easy matter, and much add to the appearance of our places of public resort, if ornamented porcelain tiles were used for flooring, perforated with holes through which the attempered air might pass, diffusing itself to every part of the house, and when vitiated, escaping through the ceiling.

At some future opportunity I may be tempted to enlarge on this point, but at present I have exceeded my intended limits, and must conclude.

I am, Sir, yours, &c.,

WILLIAM DREDGE.

10, Norfolk-street, Strand, Dec. 16, 1847.

ON THE EMPLOYMENT OF HEAT AS A MOTIVE POWER. A WORD OR TWO IN CONCLUSION BY x^2.

Sir,—I have no objection to make to the Atomic Theory; "A. H.'s" explanation of it I perfectly agree with; and neither did I, nor did I intend to "bring forwatd specific gravity as an objection to it." This theory refers, as your correspondent himself implies, to chemical phenomena only; and these chemical atoms may consist of smaller atoms, as he admits. This is all I require, for it may be precisely with reference to these smaller atoms that the question of heat is to be considered. The atomic theory has never been applied beyond its legitimate limits. Dalton, indeed, attempted to apply it to determine the specific heat of elastic fluids, upon the hypothesis that under equal pressures and temperatures their ultimate particles contained the same quantity of heat. The result of his calculations was of course utterly erroneous; as we have seen that although it may be applied correctly to solids and fluids it fails in the case of gases. Besides, I say that if it could have been taken for granted that heat might be considered as acting chemically and as a substance, it would have followed at once as a truism, and without either experiment or mathematical investigation, that the specific heats of equal weights were inversely as the atomic weights; and that in fact it is mere tautology to say so, when we have once asserted that the comparative number of atoms of two substances may be considered the same as if heat were a chemical agent.

As to the second point, I accept "A. H.'s" admission, that "if the gaseous particles repelled each other and could produce expansion without requiring any heat, then the corrections proposed would be necessary." The gaseous particles *do so*; "they *have* a repulsive influence on each other *independent of the heat communicated.*" Not, indeed, according to the law I assumed; that was a mere assumption (and I might have made any other) adopted for conveniece, and because it spared us all consideration about heat. I am not likely to forget that Boyle's law implies a constant temperature, as "A. H." will see by referring to p. 13 of your last Volume.

The real law, however, is $\frac{P'}{P} = \left(\frac{a}{x}\right)$

where P and P′ are the pressures at the heights a and x respectively. For common air $K = 1.416$. The work done, therefore, without the assistance of additional heat by a column of air of a height, a, and of such density that it exerts a pressure, P, will be, as it expands to a height, b,

$$\int_x^a P\left(\frac{a}{x}\right)^{1.416},$$

and when P is constant, and heat is added, the work done is $P.(b-a)$. The difference of the two, therefore, is *the work due to the heat alone.*

And now, Sir, I shall not trouble you, or "A. H.," with another word on the subject, as if ever we are to understand each other. we must do so now. Indeed I should have carefully abstained from saying anything, but that I imagined what called forth my remarks to be oversights, which merely required pointing out to be corrected, and as obviously erroneous as that noticed by "A. H." himself in his note at page 450. However, I was wrong, and I suppose we must agree to differ.

I am, Sir, yours, &c.

x^2

Digitized by Google

SANATARY MEASURES—MR. ELLERMAN'S ANTIDOTE.

The Marylebone Vestry having appointed a Committee "to investigate the properties of the several compounds now before the public as disinfectants or deodorisers," the Committee have made a report of their labours, from which we make the following extract:

"There are four compounds chiefly employed or recommended for the purposes in question, namely, chloride of lime; Sir William Burnett's liquid, or chloride of zinc; Ledoyen's, which is nitrate of lead; and Mr. Ellerman's, consisting of a preparation of iron.

"Chloride of lime has for many years been in use for destroying offensive odours, and is by some authorities considered a disinfectant. It has this disadvantage: that, in removing one odour, it imparts another, which, altl ough not deleterious, is by no means agreeable.

"Chloride of zinc was introduced some years ago by Sir William Burnett, as an agent, for preserving woods, ropes, sailcloth, &c., from decay. It had recently been recommended for destroying offensive odours, and preventing contagion. The former of these properties it possesses, but in a less degree than chloride of lime; and further evidence is required to establish its claim to the character of a disinfectant.

"Ledoyen's fluid, which is a solution of nitrate of lead, has a specific action on noxious matters containing sulphuretted hydrogen and sulphuret of ammonium, which are the prevailing results of the decomposition of animal and vegetable matter. It has been used with success for depriving night soil of its off nsive effluvia, and is useful in hospitals, as a means of neutralising the odour of fecal matter. It has been recommended for preventing contagion; but the evidence on this subject is not considered by the best authorities to be conclusive.

"Mr. Ellerman's fluid is also efficacious as a means of destroying the odour of night soil, and other similar substances. It possesses also this advantage, that while it neutralizes the odour so as to admit of the soil being removed at any time without creating a nuisance, it does not in any degree interfere with the efficacy of such matters as manures. On the contrary, it rather tends to increase their fertilizing quality. It is also the least expensive of the four compounds above alluded to.

"In an experiment performed by your Committee with night soil, it was found that Mr. Ellerman's fluid possessed a greater power than any of the others in destroying the smell, leaving merely a slight acid odour. Next in order, the chloride of lime was found to be efficacious, but the smell of the chloride was powerful, and continued for a considerable time. Sir W. Burnett's was less efficacious than the former fluid; and the nitrate of l ad, although producing some effect, was less powerful than the others, a large quantity being required to produce the desired result."

Mr. Ellerman's patent not having been yet specified, the particular nature of his "preparation of lead" still remains a secret.

ABSTRACTS OF SPECIFICATIONS OF RECENT ENGLISH PATENTS.

WILLIAM VICKERS, OF SHEFFIELD, STEEL-MANUFACTURER, *for improvements in the manufacture of iron.* Patent dated June 19, 1847. Specification enrolled December 12, 1847.

The improvements which form the subject of this patent consist in melting pig iron with iron turnings, or scrap iron, and in running the melted mixture, when divided into fine streams, into cold water; after which it is converted by the usual process into malleable or wrought iron.

The mode of carrying out the invention preferred by the patentee, is as follows:—When it is desired to produce wrought iron of an ordinary quality, 30 per cent. of iron turnings, or scrap iron, and 70 per cent. of pig iron, are melted in a cupola furnace, and then run into an iron tray, which is perforated with numerous holes of about half an inch in diameter, and coated on the inside to the depth of half an inch, with a composition of sand, similar to that employed for stopping the outgate of the furnace. This layer of sand is also perforated with holes of a quarter of an inch in diameter. The tray is placed about fifteen feet above a wooden tank, which is four feet in depth, and filled with water. The melted mixture, after it has been run into the tray, passes through the holes before mentioned, whereby it is divided into streams, and falls into the cistern or tank of cold water. When the iron is intended to be converted into steel, the patentee proposes to increase the proportion of iron turnings or scrap iron to 45 per cent.: he also states, that he has employed with advantage from three to five per cent. of black oxide of manganese, which he places in the tuyere holes, and, by means of the blast, introduces it into melting metal.

JOHN HORSLEY, OF RYDE, *for improvements in preserving animal and Vegetable substances.* Patent dated May 6, 1847. Specification enrolled November 6, 1847.

Mr. Horsley makes use of a preservative liquor thus prepared:—"I first perfectly neutralize strong acetic acid (I prefer that known as Beaufoy's concentrated acetic or pyroligneous acid) with the salt called sesqui carbonate of ammonia, the result being the formation of an acetate of ammonia, which is eminently volatile, and is given off in the act of cooking. I then dissolve in such quantities as may be thought necessary, say eight, nine, or more imperial pints of water, which has been well boiled, to free it from air and other impurities, and filtered through animal charcoal, a small quantity, say from six to twelve ounces of chloride of sodium (common salt.) To this solution I add two imperial pints of the neutral acetate before mentioned, though I do not confine myself to any of these particular quantities, a little flavouring of spice being added if required."

The patentee applies this liquid in two ways:—"In the preservation of meat, fish,

Digitized by Google

&c., for the purposes of food, I have two methods of procedure; either by simple immersion of the same in a certain liquid hereafter mentioned, or injecting the same, and then packing articles so prepared between layers of charcoal, or any other equally sweet and absorbable material, not liable to fermentation, in a suitable air-tight vessel, the charcoal being also saturated with the liquid. When it is required to keep longer than fourteen days, I prefer the latter method.

"Meat thus treated is either put up into vessels, and covered with the liquor, or it may be wrapped up in the linen or any other fibrous material, saturated with the liquid, and placed between layers of sifted charcoal, or any other equally sweet and absorbable material, in such vessels as may be found to conduce to the safe keeping of the meat, as well as resist the action of the fluid or gaseous matter therein contained."

What the patentee claims is—"The use of ammonia in such a combination with acetic or purified pyroligneous acid as shall not interfere with the principle of decomposition or volatilization of their elements upon the application of heat, or in the act cooking."

Azulay and Solomon's Patent Fuel.

We have received a letter from Mr. Azulay, calling upon us, "as an act of common justice," to give "chapter and verse" for our assertion "that there is nothing new in his mode of manufacturing artificial fuel." "I have never," he says, "before heard it proposed to reduce charcoal, &c., to powder before *compressing*." We readily respond to Mr. Azulay's call. In the specification of a patent granted to Mr. M. J. Cooke, March 2, 1843, he directs coal, coke, or charcoal to be first ground to a fine powder, then mixed with other ground materials, and finally subjected to as high a pressure as is requisite "to render the mixture perfectly solid." And, subsequently to Cooke's patent, there have been several others, which consist chiefly of improved modes of effecting the grinding and compression. We need only refer to those of Wylam, April 7, 1845; and Bertram, May 26, 1846. The Wylam fuel was that to which we particularly referred as being all that could be desired. It is now, we believe, more extensively used than any other.

WEEKLY LIST OF NEW ENGLISH PATENTS.

William Westbrooke Squires, of Paris, M. D., for a mode or modes of producing a vacuum, which mode or modes may be applied to pneumatic, hydraulic, and hydrostatic apparatus, and to machinery for obtaining motive power. December 18; six months.

Richard Wrighton, of Lower Brook-street, Grosvenor-square, Middlesex, gent., for improvements in apparatus to be applied for railway carriages and engines. Dec. 22; six months.

Charles André Felix Rochaz, of Paris, merchant, for certain improvements in treating zinc ores, and in manufacturing oxide of zinc. Dec. 22; six months.

Henry S. Baker, of Boston, in the United States, of America, for a certain new and useful improvement in steam-boiler furnaces. Dec. 22; six months.

Richard Baird, of Dundee, Scotland, engineer, for a new or an improved method of communication between the guards, engine drivers, and other servants in charge of trains of carriages and wagons on railways, and also between the passengers and engine drivers and other servants in charge of such trains. Dec. 22; six months.

Robert Stamp, of Chelsea, hatter, for improvements in the manufacture of fabrics to be used for covering hats, caps, and bonnets, which fabrics may be used for other articles of wearing-apparel. Dec. 22; six months.

Charles William Siemens, of Manchester, engineer, for improvements in engine- to be worked by steam and other fluids. Dec. 22; six months.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date of Registration.	No. in the Register.	Proprietors' Names.	Addresses.	Subjects of Designs.
Dec. 17	1296	Thomas Robert Hill	Church-street, Soho	Travellers' door-fastener.
,,	1297	Edward John Payne	Chancery-lane	Flanged roller for rolling metals.
18	1298	Samuel Siddall	Dronfield, Derbyshire	Reaping-hook.
20	1299	William Bridges Adams	Fair Field Works, Bow	Axle-guard for railway carriages.
21	1300	John Spurgin, M.D.	Guilford-street, Russell-square, London	Hall shoe-scraper and brusher.
23	1301	Robert and William Hawthorn	Newcastle-upon-Tyne	Parts of locomotive engines with cranked-axles.
	1302	Joseph Dixon	Manchester	Universal mule drum.

Digitized by Google

Advertisements.

Encyclopædia of Astronomy.

On 1st January, in 4to, with Twenty-two Engravings, Price 21s., Cloth,

THE ENCYCLOPÆDIA OF ASTRONOMY:

Plane Astronomy, by Professor Barlow; *Nautical Astronomy*, by Capt. Kater; *Physical Astronomy*, by Sir J. H. W. Herschel; *Tides and Waves* and *Figure of the Earth*, by G. B. Airy, Esq., Astronomer Royal. Being the Fifth Volume of the Monthly Re-issue of the *Encyclopædia Metropolitana*.

JOHN J. GRIFFIN AND CO., Chemical Museum, 53, Baker-street, London; and R. Griffin and Co., Glasgow.

Dredge's Improved Furnace and Registered Fire-Bar.

For Licences and Particulars apply to Mr. DREDGE, 10, Norfolk-street, Strand, London.

Gutta Percha Company, Patentees,

Wharf-road, City-road, London

October 1, 1847.

THE GUTTA PERCHA COMPANY, in requesting the attention of the Public to the accompanying Testimonials, have great pleasure in stating that the steadily increasing demand for the PATENT GUTTA PERCHA DRIVING BANDS justifies the utmost confidence that they are fully approved.

Their durability and strength, permanent contractility and uniformity of substance—their insusceptibility of injury from contact with Oils, Grease, Acids, Alkalies, or Water, and the facility with which the single joint required can be made in Bands of an indefinite length, render them superior for almost all working purposes, and decidedly economical.

Galoshes, Tubing of all sizes, Bougies, Catheters, and other SURGICAL INSTRUMENTS; MOULDINGS FOR PICTURE-FRAMES and other decorative purposes; WHIPS and THONGS, TENNIS, GOLF, and CRICKET BALLS, are in a forward state of manufacture, and will be very shortly ready for sale.

All orders forwarded to the COMPANY'S WORKS, WHARF-ROAD, CITY-ROAD, will receive immediate attention.

Haslingden, September 4, 1847.

Dear Sir,—We have now been using the Gutta Percha Straps for the last eight months, and have great pleasure in saying they have answered our most sanguine expectations; and we may add, that some of our machines which required a 12-inch leather strap, and which almost daily required to be repaired, we have been turning the same with the Gutta Percha straps 10 inches only for the abovenamed period, and now find them as good as the day they were first applied.

We remain, yours respectfully,
W. & R. TURNER.

To S. Statham, Esq., Gutta Percha Company.

Atlas Works, Manchester, Sept. 1, 1847.

Sir,—In reply to your inquiry as to the result of our experience with the Gutta Percha Straps, we have great pleasure in stating that the advantages they possess are so very manifest as to induce us to apply them in almost every instance where new straps are required.—We are, Sir, very respectfully,
SHARP, BROTHERS.

Samuel Statham, Esq., Gutta Percha Company.

Bridgewater Foundry, Patricroft, near Manchester, Sept. 3, 1847.

Sir,—In reply to your inquiry respecting how we like your Gutta Percha Machine Straps or Driving Belts, although we have not had quite so much experience in the above-named use of Gutta Percha as we hope to have, so far as we have employed it, it has given us general satisfaction. The beautifully straight and regular manner in which it runs on the pulleys, especially on our cone of speed pulleys, is a strong recommendation in its favour; and although we are inclined to think it does not take so fast a grip on the pulley as leather, yet there is ample hold for all general purposes. We shall continue to use it and to give it our best attention, so as to learn how to employ to best advantage the many excellent qualities it possesses over the ordinary leather belts.

NASMYTH, GASKELL, & CO.

S. Statham, Esq., Gutta Percha Works, London.

Manchester, 18th June, 1847.

Dear Sir,—We beg to inform you that we have now had the patent Gutta Percha Bands or Straps in use for more than six months. For tube frames we consider them very much superior to anything we have tried before. They also do very well as open straps for mules, throstles, looms, &c.

We are, Sir, yours respectfully,
THOS. DODGSHON & NEPHEWS.

Mr. Samuel Statham, Gutta Percha Company.

Wellington Mills, Stockport, 4th September, 1847.

Gentlemen,—We have much pleasure in bearing our testimony to the valuable qualities of the Gutta Percha for driving bands. We have found it answer exceedingly well in most cases where we have tried it, and we think it has only to be made known to ensure its very general use.

We are, Gentlemen, yours obediently,
HOLE, LINGARD, & CRUTTENDEN.

To the Gutta Percha Company, City-road, London.

Tottington Hall, near Bury, Lancashire, September 3, 1847.

Dear Sir,—Your letter of the 31st August is to hand, and in answer respecting the use of your Gutta Percha Bands, I cannot give you a better proof of our approval of them in preference to leather straps, than having given an order for another to your partner, yesterday, to be in readiness in case of accident. They are decidedly preferable to the old straps; and we can recommend them with the greatest confidence to any person for Driving Straps.

For HALL & GORTON, THOMAS GORTON.

S. Statham, Esq., Gutta Percha Company.

Brewery, 16th September, 1847.

Gentlemen,—We have much pleasure in repeating our testimony to the very great improvement effected by the use of Machinery Bands made of your material instead of leather: the stoppage of parts of our works, through the failing of the leather straps, used to be of daily occurrence, causing great inconvenience and expense. With this annoyance we are now never troubled, and are assured by our superintendent that the advantage of using your material is surprising, as regards economy and saving of trouble. We confidently recommend it to machinists and factories for general adoption.

TRUMAN, HANBURY, BUXTON, & CO.

To the Gutta Percha Company.

Digitized by Google

Patent Gutta Percha Soles for Boots and Shoes.

The capabilities of the GUTTA PERCHA SOLES FOR BOOTS AND SHOES having been extensively and satisfactorily tested, we can unhesitatingly recommend the material prepared for the purpose, its merit having been acknowledged by all who have worn it. Indeed, experience has proved that Gutta Percha Soles wear twice as long as leather, with great additional personal comfort, and they remain perfectly impervious to wet until quite worn through.

23, Southampton Row, 1st Sept., 1847.

Gentlemen,—I write to thank you for allowing me to use the new PATENT GUTTA PERCHA SOLES. I felt annoyed at not being allowed to use them from the time I had first worn them, namely, from last October, but am not sorry now, because I can speak confidently of their advantages over leather soles. I made the first pair last October, and wore them eight months before I wore the soles through. I had them heeled six times, and one pair of extra fronts I put to the same soles. *I only kept the one pair in wear to see how long they would last.* I will never wear another leather sole so long as I can get GUTTA PERCHA SOLES, and I walk from 12 to 20 miles a day.

C. WRIGHT, Boot and Shoe-maker.

To the Gutta Percha Company.

9, Gloucester Row, Hoxton, 5th July, 1847.

Sir,—I beg to thank you for the boots with GUTTA PERCHA SOLES which I had from you on the first of the year. I have had them in constant use for nearly five months, the greater portion of that time being the most inclement period of the year; and from my occupation as a general post letter-carrier, you may be sure that they have had more than a common fair trial, and the Gutta Percha seems now as firm and as little worn as on the first day. W. HUTTON, G. P. O. Letter Carrier.

To E. Granville, Esq., Gutta Percha Works.

28, St. John-street, August 25th, 1847.

Gentlemen,—It gives me great pleasure to acquaint you that the Gutta Percha Soles I had from your Works have answered the purpose admirably, as I can fully testify, having had them in wear six months, during the winter, in Smithfield-market, and have not been subjected to the annoyance of wet feet, as is often the case with leather soles, and, in my opinion, they wear three times as long.

H. I. TARLING.

To the Gutta Percha Company.

N.B.—The above Soles, which are not worn out, may be seen at the Gutta Percha Company's works.

No. 3, Union place, New-road,

Dear Sir,

I have worn the Gutta Percha Soles for nearly a year, with much satisfaction and comfort: in wet and cold weather they keep the feet perfectly dry and warm—are pleasant to wear, and I have found them more durable than leather.

I am, Dear Sir, yours faithfully,

W. GORTON.

To the Secretary of the Gutta Percha Company.

What to Eat, Drink, and Avoid.

Sound digestion! What a boon; but what a rarity. All the wealth in the world cannot buy it, and yet how simple it is to secure it. Dreamless nights!—How refreshing is a good night's rest, and how few obtain it! How fearful is illness, and who have we to blame for it but ourselves! Physic is one evil to cure another; but caution keeps off more fire than water quenches. Reader, if you value the desiderata of good health in the day, and tranquil repose at nights, together with mental serenity at all times, or should lack firmness of nerve or purpose, or suffer from the sorrows of an afflicted body seek how to obtain the former, and remove the latter, in DR. CULVERWELL'S little Memoirs, called "HOW TO LIVE; or, WHAT TO EAT, DRINK, and AVOID;" and its Companion—"HOW to be HAPPY" (the price is but 1s. each if by post, 1s. 6d. in stamps.) They recommend no nostrum, pill, or balm, but render every possessor master or mistress of his or her own case. They tell home truths, and detail facts that may astound, but which are worthy of recognition, and they furthermore unmystify the laws of life, health, and happiness; that how to live happily and contentedly, is rendered clear and open to the humblest intelligence. To be had of Sherwood, 23, Paternoster-row; Carvalho, 147, Fleet-street; Mann, 39, Cornhill; Nelson, 457, West Strand, and all booksellers; or direct from the Author, 10, Argyll-place, Regent street; who can be personally conferred with daily till four, and in the evening till nine.

Just Published, Price Five Shillings,

MICROSCOPIC OBJECTS, ANIMAL, VEGETABLE, and MINERAL.

CONTENTS:

Catalogue of 1932 Microscopic Objects.
Recent Improvements in Microscopes.
Observations on the Catalogue of Microscopic Objects.
Test Objects.
Animals and Plants exhibiting Circulation.
Microscopic Objects by Polarised Light.
Preparing and Mounting Microscopic Objects.
Microscopic Fragments.
Achromatic Microscopes.
The Megaloscope (a new Optical Instrument.)

London: Whittaker and Co., Ave Maria-lane.

Erratum.—In our weekly List of Patents, No. 1219, the following was omitted:—"John Harvey Sadler, of Holbeck, Leeds, Scotch iron merchant, for improvements in constructing bridges, aqueducts, and similar structures. Sealed July 7, 1847."

CONTENTS OF THIS NUMBER.

Description of Pooley's Patent Improvements in Weighing Machines—(*with engravings*).... 611
Gaskin's "Solutions of Geometrical Problems"—(*review*) 619
Note on "Hearn's Researches on Curves of the Second Order" 619
On the Causes of the Fracture of Axles. By Mr. H. Jas. Rock, Jun 624
On the Law of Connection of Bernoulli's Numbers. By Professor Young 627
Hints on Ventilation. By W. Dredge, Esq., C. E. 628
On the Employment of Heat as a Motive Power.—A Word or Two in Conclusion. By *x2* 630
Sanatory Measures.—Mr. Ellerman's Antidote 631
Abstracts of Recent Specifications of English Patents.—Vicker's Improvements in Iron.—Horsley's Meat Preserving Process 631
Azulay and Solomon's Patent Fuel 632
Weekly List of New English Patents 632
Weekly List of Articles of Utility Registered... 632
Advertisements 633

NOTICES TO CORRESPONDENTS.

† *In our next.*

We have already informed "J. W." that his problem cannot be inserted.

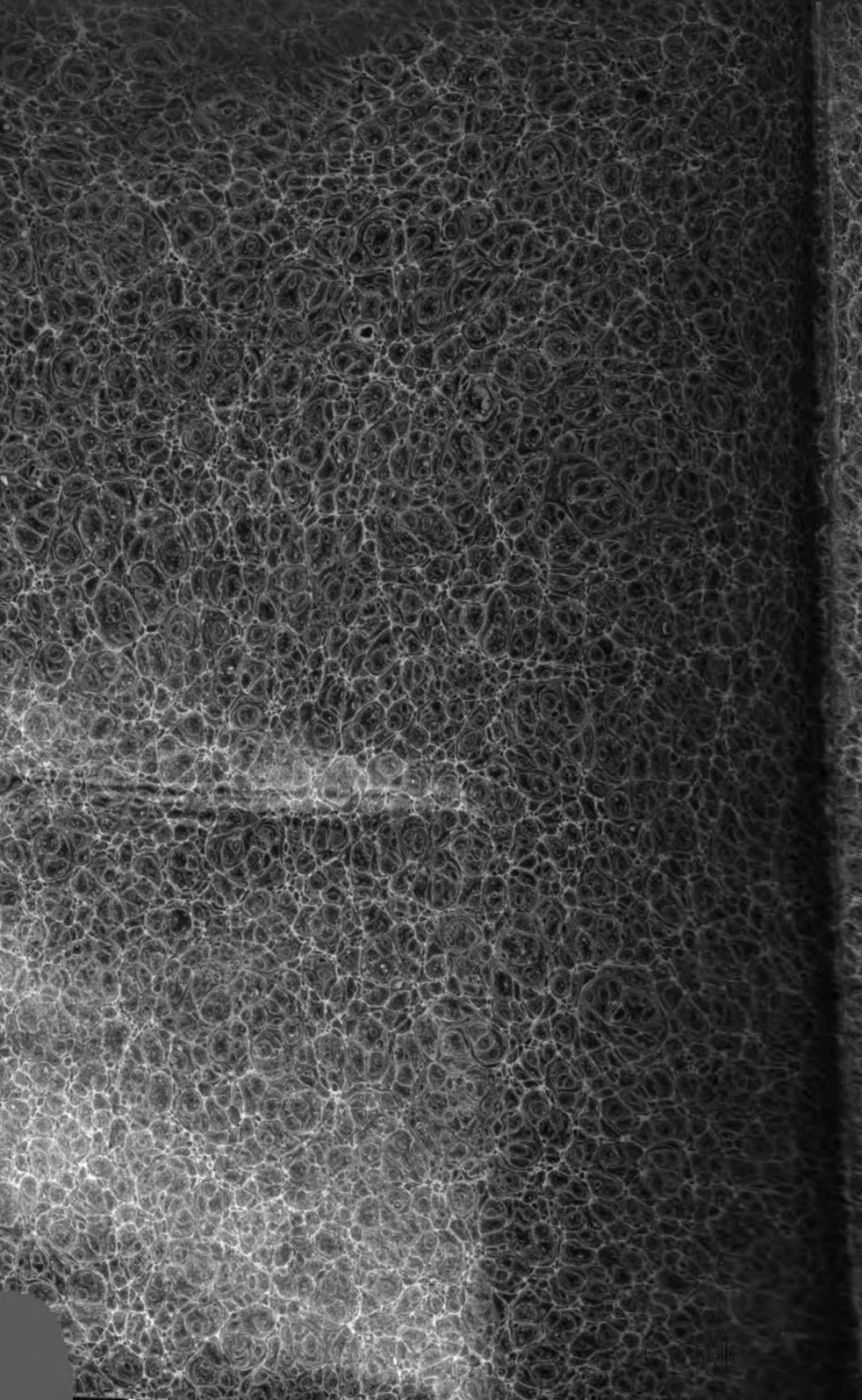
Communications received from Mr. Wheeler—M. N. C.—Mr. Clive—Mr. Ballingall.

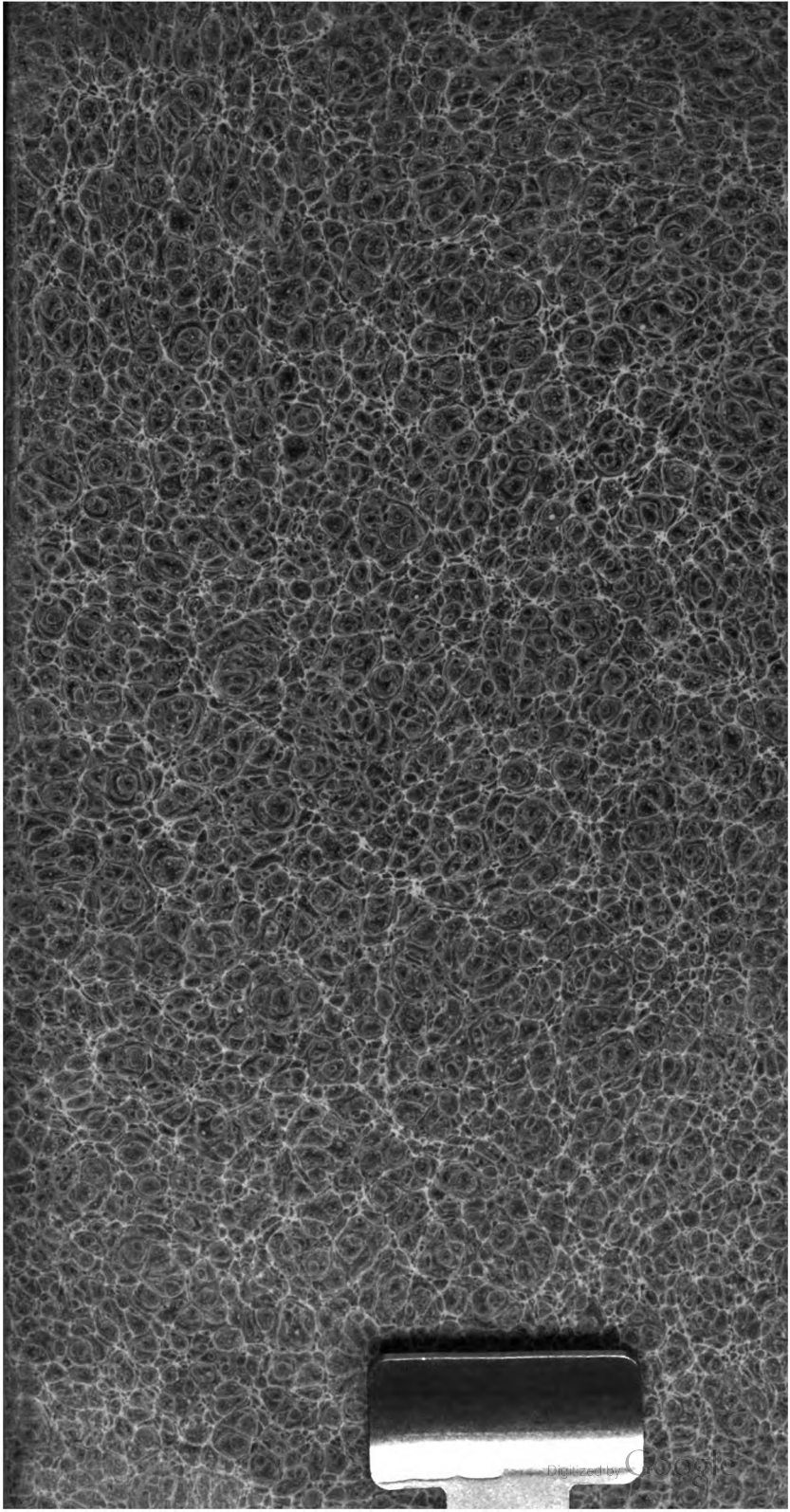
LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

END OF VOLUME XLVII.

Digitized by Google

Digitized by Google




Digitized by Google

Digitized by Google